SCIENTIFIC AMERICAN

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THE PARIS EXHIBITION.

The International Avenue, which forms the subject of the engraving on this page, runs from end to end of the building on the Champ de Mars, and divides the French from the foreign half of the exhibition. It is a thoroughfare eight hundred yards in length, bordered on one side by French houses and *façades* of French sections; while the other is occupied by houses built according to the various styles of architecture which have found favor in different countries in ancient and modern times. Here stands the Prince of Wales' Magic Indian Pavilion, close by a model factory, and a little beyond a row of pretty English villas. Sweden, Norway, and Italy exhibit model buildings of brick or wood, and miniature palaces of marble; Switzerland, some picturesque cottages and dairies; Russia, its curiously painted houses; and almost every other European country contributes its sample of architecture. The United States and South America have their respective exhibits, as have also Japan, China, Morocco, and other countries. The houses of each nation form the *façade* to its industrial and art sections, which lie behind; and the whole, the London *Graphic* declares, forms a grand street of multiform architecture such as has never before been seen.

A Honey Bee Ship.

A floating bee house has been constructed by Mr. Perrine, a Chicago honey dealer, large enough to accommodate two thousand hives, which he is having towed up the Mississippi river from Louisiana to Minnesota, keeping pace with the blossoming of the flowers, and thus stimulating the honey making ability of his bees. Returning, he will stop about two months somewhere above St. Louis, and will reach Louisiana in October. He wants to take advantage of the autumnal flowers at each point, just as he does of the spring flowers up the river. The plan of moving the bees to get the benefit of fresh flowers has been tried in a small way in some parts of Europe. It is possible that honey bee ships might advantageously be sent out in winter to the West India islands to cruise for honey after the manner above described.

The Government Surveys.

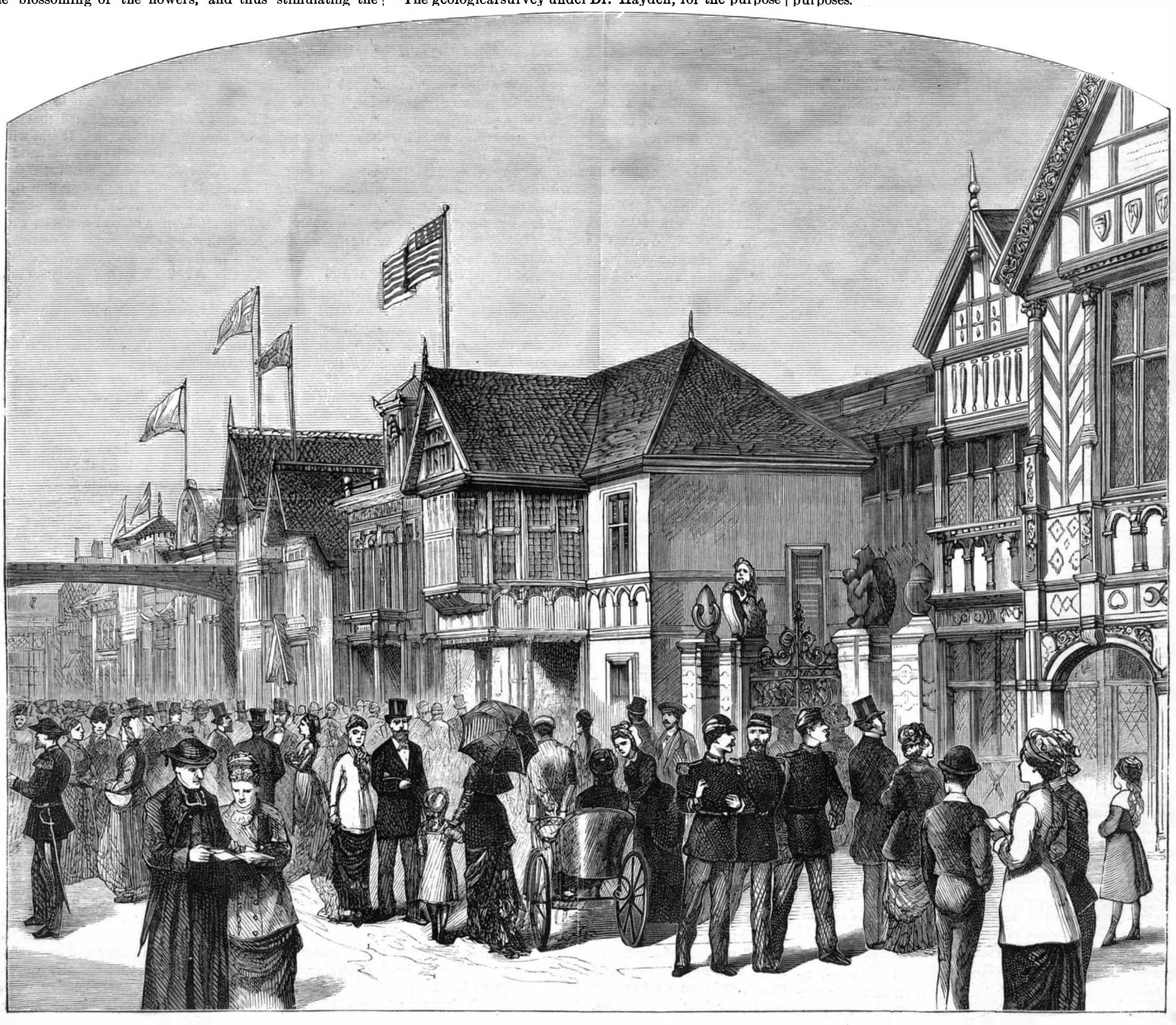
Documents transmitted to Congress show that there are three government surveys in progress—one geographical and two geological in their main features; the first under the corps of engineers of the War Department, and the last two under the Interior Department, in charge, in their order, of Lieutenant Wheeler, F. V. Hayden, and J. W. Powell. The first is prosecuting a geographical survey west of the one hundredth meridian, by means of astronomical, geodetic, topographical, and meteorological observations, with a view to a comprehensive and accurate map of the whole area on a uniform scale, and includes observations on important branches of natural history to such an extent as the present developments of that country require. It has at this time surveyed 332,515 square miles, and mapped 244,000 square miles; and the cost for ten years has been $499,316.77, or $1.48 per square mile. It will cover the entire area in twenty-five years.

The geological survey under Dr. Hayden, for the purpose of better expressing its results, has of late carried on topographical work, and uses topographical sheets as the basis of its geological maps where the geology of the country is of sufficient importance to be graphically illustrated. This survey has covered in ten years 100,000 square miles, and mapped 75,000, at an expense of $619,001.68, or $6.19 a square mile. At its average rate of progress it will complete the area of the territories alone in 94·2 years.

The geological surveying party under Mr. Powell says that it has covered in ten years 59,936 square miles of completed work, and 21,179 square miles of imperfect reconnoissance, at a cost of $225,125, or $3.71 per square mile for completed work. The time required to complete the area west of the 100th meridian would be 182·6 years.

We are promised by these surveys, at the end of their respective labors, a complete map of the entire area, based upon geodetic methods, with as much geological and allied information as is needed in advance of settlement, the completed geology of this partly developed region, with such topographical information as is required for geological illustration, with the results of allied observations.

OZONE.—M. Eremin has made experiments with ozone. He found that in oxalic acid solutions ozone may be preserved longer than while using other fluids for this purpose. Another fact is very remarkable: the decomposition of ozone in sunlight is slower than in the dark; also, ozone which, after preparation, was left for some time, and was not immediately used, had a more energetic action for disinfecting purposes.



THE INTERNATIONAL AVENUE AT THE PARIS EXHIBITION.

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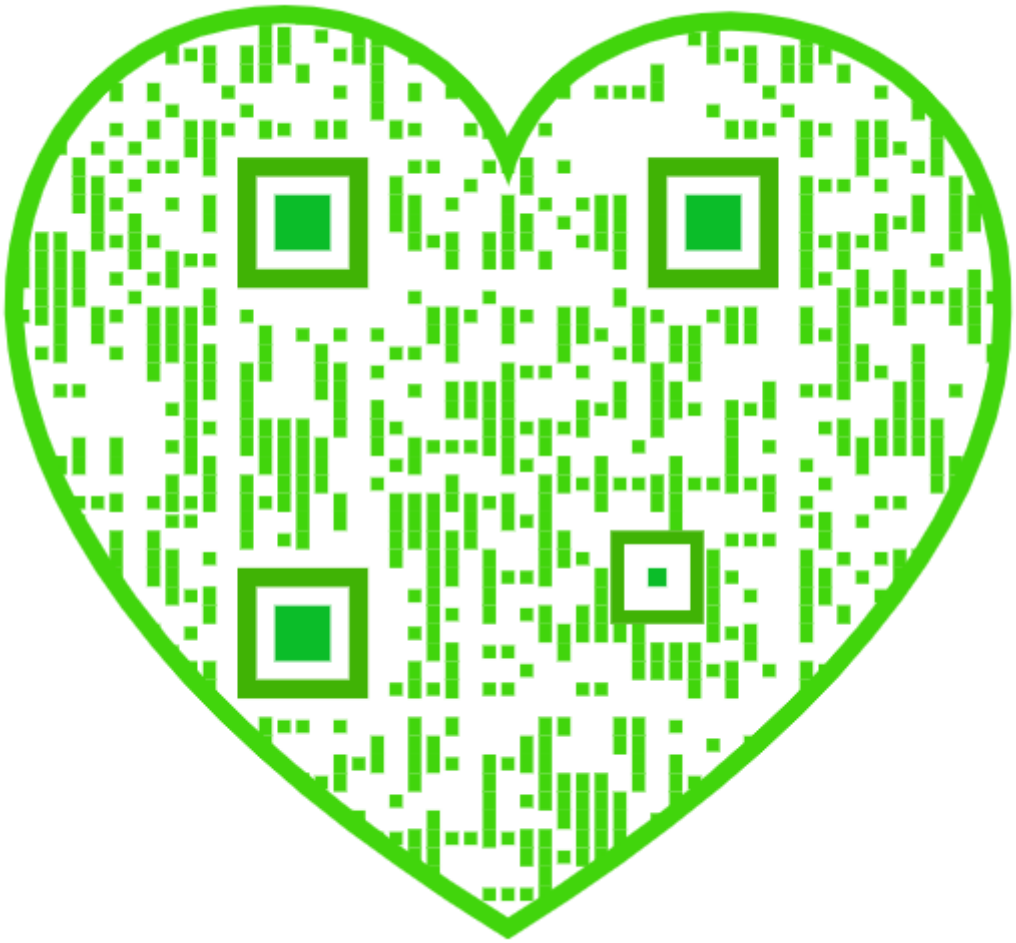

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NEW YORK, SATURDAY, JUNE 22, 1878.

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II. CHEMISTRY AND METALLURGY.—The Application of Polarized Light to the Examination of the Alkaloids of the Quinin Group. By HENRY A. MOTT, JR. With table showing deportment of the alkaloids with reagents, melting points, solubility in water, ether, etc., and action on polarized light. Examination of sample of unknown composition. Explaining method.—Vegetable Chemistry.—Fluoranthene.—Ammonium Nitrite.—Influence of Different Gases on Fermentation.—Sugar in the Alimentary Canal.—Chemical Action of Electric Discharge.—Separation of Minerals.—Determination of the Fat in Butter.—Action of Hydrocyanic Acid.—Hydrocyanic Acid.—Green and Blue Ultramarine.—Fluid Cavities in Blende.—Melting Points.—Analysis of Soils.—Alcoholic Potassa.—Hydrogen Peroxide.

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IV. ELECTRICITY, LIGHT, HEAT, ETC.—Experiments with Floating and Suspended Magnets, illustrating the action of atomic forces, the molecular structure of matter, allotropy, isomerism, and the kinetic theory of gases. By ALFRED M. MAYER. With 22 figures. Phenomena of compressibility and porosity. Two elementary chemical laws; and the modern doctrine of the composition of matter clearly explained. The kinetic theory of gases. Matter in constant motion. Character of motion. The diffusion of gases explained. Effect of heat. Allotropy and isomerism explained. The same elements occurring under different forms. The expansion of freezing water. Minute directions for performing pleasing and instructive experiments illustrating the foregoing laws of matter, the only materials required being a bar magnet and a few needles and corks.

V. NATURAL HISTORY, GEOLOGY, ETC.—The Interior of the Earth. Abstract of address at the Cumberland Association for the Advancement of Literature and Science. By Sir GEORGE B. AIRY, F.R.S. Triangulation, and how the Globe is measured. Dimensions and form of the Earth. Variable density of Earth; tremendous pressure at its center. Rotation of the Earth. Fluid condition of its interior; singular occurrence in surveying. Heat of the Earth; volcanic action everywhere. Earth's magnetism and its variations. How the Earth was formed. Nebulæ, what they are; Heat from their condensation; curious characteristics; the Nebular Hypothesis. What the Spectroscope reveals. Density of Earth, Sun, and Planets, cause of volcanic action. Description of the probable interior of the Globe.

VI. MEDICINE AND HYGIENE.—Dyspepsia. By Dr. C. F. KUNZE. Symptoms. Appetite diminished. Stomach digestion much slower than normal. Constipation. Symptoms in children. Chronic cases. Dyspepsia as caused by too much food; by indigestible food. Dyspepsia as caused by general derangement; by altered condition of innervation. Treatment; nourishment should be easily digested; taken little at a time; and should be digested before more is taken. Food should be plain when stomach is overloaded. Deficiency of Hydrochloric Acid in gastric juice, and how remedied. Treatment in febrile diseases.

VII. AGRICULTURE, HORTICULTURE, ETC.—The Seed Trade. By ANDREW J. LAWSON.—Peach Gardens of France.
Irish Short-Horn Cattle. Bull, "White Boy," and Roan Heifer, "Lady Violet," with illustration of each.

VIII. CHESS RECORD.—Biographical Sketch and Portrait of J. A. De Riviere, with one of his games.—Problem by Rudolph Wilmers.—Letter Problem.—Problem by Samuel Loyd.—Enigma by Conrad Bayer.—American Congress Public Tourney of '57.—Solutions to Problems.

THE PROBLEM OF UNSINKABLE SHIPS.

A collision in the British Channel between two large German ironclads, the Grosser Kurfürst and the König Wilhelm, recently resulted in the sinking of the former vessel and the drowning of nearly 300 of her crew. The Kurfürst, which was leading the squadron, two other ships following close in rear, changed her course to avoid a crossing merchant ship. The König Wilhelm attempted to do likewise, but it is alleged that she refused to mind her helm, and thus came into collision with the Kurfürst, ramming that ship about amidships, and causing her to sink almost instantly. The weather was fine and sea smooth, so that the evil done was restricted wholly to the effects of the blow.

This disaster calls for something more than passing comment, not merely because it adds another item to the already long list of similar casualties among modern European ironclads, but for the additional reason that here was a splendid vessel, fitted with the most improved appliances to prevent or retard the very fate which she encountered, but which proved manifestly unavailing. She had a double skin, divided into watertight compartments, which were even carried to the extreme ends of the vessel to prevent possible injury to these usually unguarded portions. Besides these fore and aft compartments the entire ship below the battery deck was transversely divided into twelve sections, provided with watertight doors. The appliances for freeing her of water were apparently ample for any emergency. A 12½ inch pipe was laid through the main compartments, and provided with branches communicating throughout the ship, and also with the powerful pumps connected to the engines. Supplementary to these pumps were four other pumps on the battery deck, calculated to be used in case of any failure of the main engine, and considered alone fully capable of dealing with any ordinarily severe leak. The ship was 298¼ feet in length, 52 feet beam, 23 feet deep, and measured 6,558 tons. Her engines, under test, had driven her at a speed of 14 knots, developing 5,327 horse power. She had one turret with 10·32 inches of armor, and was a comparatively new vessel, having been launched in 1875.

When a ship apparently has her whole interior divided into cells, between which water communication can be cut off at will, and besides possesses enormously powerful engines and pumps, it might be supposed that she was proof against any accident which might result in destroying two or three compartments; that is, that she would at least float long enough to be brought into the nearest port, the weather being fair. This might be predicated of a merchant vessel not primarily designed to meet the possibly severe injury which a man of war must encounter in action, while the latter as a first requisite, it would seem, must possess the capability of remaining on the surface and fighting her guns until literally overwhelmed. It is a significant commentary, however, that after all the immense sums spent abroad on war vessels, all especially designed to ram and to withstand that mode of attack, the only times that they have been subjected to actual crucial test of their resistance they have sunk almost instantly. The Vanguard after the Iron Duke's blow floated long enough for her crew to be removed, and she is still on the bottom; the Kurfürst heeled over and went down inside of five minutes. It has been proved that the famous Inflexible, should her unprotected ends be knocked away in action, would turn over and sink despite her compartments, and when merchantmen are considered the almost certain destruction of every one that grounds (the Idaho of the Williams & Guion line just lost on the Irish coast is the latest example)—all goes to show the fact that we have very much to discover before the problem of building unsinkable ships can be solved.

The subject is one to which inventors may profitably devote patient study, and whether the present compartment system can be supplanted by a better one is a question for them to decide. There is no doubt that, had the Vanguard's compartments been closed, the uninjured ones would have floated her; the same is probably as true of the German ironclad. But both instances demonstrate beyond any doubt that, when a large hole is suddenly made in a vessel's side, there is no time to shut doors and isolate the compartments before the ship is past recovery. This suggests the idea of arranging sliding compartment doors in connection with machinery, which by a turn of a wheel will close all instantly.

This is simply a matter of mechanical detail. The recent casualty also suggests the possible necessity of new steering arrangements for such immensely heavy vessels—which oppose their excessive momentum to any change of position of the rudder, and hence steer slowly. The disaster also lends additional force to the arguments we have already advanced as indicating the many shortcomings of the modern ironclad, and the likelihood of its playing no important part in future wars.

THE PHONOGRAPH WINS A VICTORY.

The phonograph has been distinguishing itself lately in this city by its remarkably accurate reproductions of the cornet solos of Mr. Levy, the famous performer on that instrument. Mr. Levy possesses the phenomenal ability of getting notes out of the cornet which, he says, "are not there," or in other words, he plays airs in notes an octave lower than any one else has succeeded in producing on the cornet, and thus he has extended the range of his instrument over four full octaves. The phonograph, however, not only follows Levy, but surpasses him, by reproducing cornet notes in entirely new octaves of its own origination, proving itself to have a compass of extraordinary range, if not especial tunefulness and brilliancy.

At a very pleasant reception given to Mr. Edison recently, in this city, a most interesting conflict between Levy and the phonograph occurred. Messrs. Edison and Johnson ably seconded the phonograph, and of course none but Levy could scientifically manipulate the cornet. Fresh tin foil being adjusted on the cylinder, the bell of the cornet was placed near the mouth piece, and Yankee Doodle, first plain, and then garnished with variations of the most decorative character, assumed the form of dots on the foil. Without the loss of a note, the phonograph repeated it, and not only this, but even the peculiar expression imparted by the player, and the triumphant kind of a flourish which brought the tune to a conclusion, were reproduced with wonderful accuracy. After several other popular airs had been similarly replayed, Mr. Edison showed the effect of turning the cylinder at different degrees of speed, and then the phonograph proceeded utterly to rout Levy by playing his tunes in pitches and octaves of astonishing variety. It was interesting to observe the total indifference of the phonograph to the pitch of the note it began upon with regard to the pitch of the note with which it was to end. Gravely singing the tune correctly for half a dozen notes, it would suddenly soar into regions too painfully high for the cornet even by any chance to follow it. Then it delivered the variations on Yankee Doodle with a celerity that no human fingering of the cornet could rival, interspersing new notes, which it seemed probable were neither on the cornet nor on any other instrument—fortunately. Finally the phonograph recited "Bingen on the Rhine" after its inventor, then repeated the poem with a whistling accompaniment, then in conjunction with two songs and a speech, all this on one tin foil, though by this time the remarks began to get mixed. Just here Levy returned to the charge, and played his cornet fiercely upon the much indented strip. But the phonograph was equal to any attempts to take unfair advantage of it, and it repeated its songs, and whistles, and speeches, with the cornet music heard so clearly over all, that its victory was unanimously conceded, and amid hilarious crowing from the triumphant cylinder the cornet was ignominiously shut up in its box.

The occasion of Mr. Edison's reception was the exhibition of a fine organ made by Mr. Hilborne L. Roosevelt, of this city, for the Episcopal church in Rome, Italy. Some one, a reckless partisan of the phonograph, who was affected with enthusiasm over the victory of the instrument, and also by the fumes of the carbonic acid from a vinous beverage of French extraction, suggested that the phonograph be pitted against the grand organ. It was with difficulty that Mr. Edison, who, during the evening, had repeatedly manifested a desire to do this, could be persuaded into confining himself to the simple assertion that it would be successfully done some time, and the phonograph was thus saved the strain of a second struggle, with a more formidable competitor.

REAPERS AND MOWERS AT THE PARIS EXPOSITION.

We publish elsewhere in this issue an admirable letter from Mr. Edward H. Knight, our correspondent at the Paris Exposition, in which a careful comparative study of the various reapers and mowing machines there exhibited is made. Mr. Knight's analysis of the essential portions of the French machines, and his showing of how they are all, in very large part, of American origination, is exceedingly instructive and valuable, not merely as indicating how quick foreign manufacturers are to adopt American devices, but as proving how necessary these contrivances have become in an entire great class of labor-saving machinery the world over. The account of the cool piracies by Canadian and Swedish manufacturers of Adriance and Platt machines will prove as amusing to our readers, we imagine, as it will distasteful to the parties implicated when they learn of the exposure.

It is scarcely necessary for us to add that Mr. Knight is especially well qualified for the presentation of a discussion and report of this kind. He is a mechanical engineer of superior ability, author of the "Mechanical Dictionary" which bears his name, an old attaché of the Patent Office, and generally one of the best informed men on mechanical subjects now living.

Opening of the Metropolitan Elevated Railroad.

Trains on the Metropolitan Elevated Railroad (formerly the Gilbert) began trips on June 5th. Immense numbers of people crowded the cars, until even the platforms were full. The time between Trinity Church and Central Park averaged about twenty-seven minutes, including stoppages, and there was but one accident—a locomotive leaving the track and running into a couple of cars, through some error in placing a switch. Until the stations are completed and gas introduced no trips are to be made after dark. During the day it is intended that they shall take place every five minutes.

It seems likely that the road will be more of an annoyance to dwellers along Sixth avenue than has been supposed, owing to the noise of passing trains being greatly intensified by the resonance of the large iron supporting structure. In the tunnel under the latter the sound of a train passing overhead is deafening, and the street car horses have repeatedly taken fright and run away. Whether the equine population of the city will become accustomed to this is questionable; and for the present at least prudent drivers of private vehicles will avoid streets through which the line passes.

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EDISON'S MICRO-TASIMETER.

The latest of Edison's inventions, and perhaps the most interesting to physicists, is his micro-tasimeter, or measurer of infinitesimal pressure.

The thermopile, hitherto foremost among delicate indicators of changes of temperature, must now be consigned to the rear ranks, and the radiometer, which exhibits the motive power of the most subtile of forces, must retire in favor of an instrument that can weigh that force.

The micro-tasimeter is the outcome of Professor Edison's experiments with his carbon telephone. Having experimented with diaphragms of various thicknesses, he ascertained that the best results were secured by using the thicker diaphragms. At this stage he experienced a new difficulty. So sensitive was the carbon button to changes of condition, that the expansion of the rubber telephone handle rendered the instrument inarticulate, and finally inoperative. Iron handles were substituted with a similar result, but with the additional feature of musical and creaky tones distinctly audible in the receiving instrument. These sounds Professor Edison attributed to the movement of the molecules of iron among themselves during expansion. He calls them "molecular music." To avoid these disturbances in the telephone, the handle was dispensed with; but it had done a great service in revealing the extreme sensitiveness of the carbon button, and this discovery opened the way for the invention of the new and wonderful instrument.

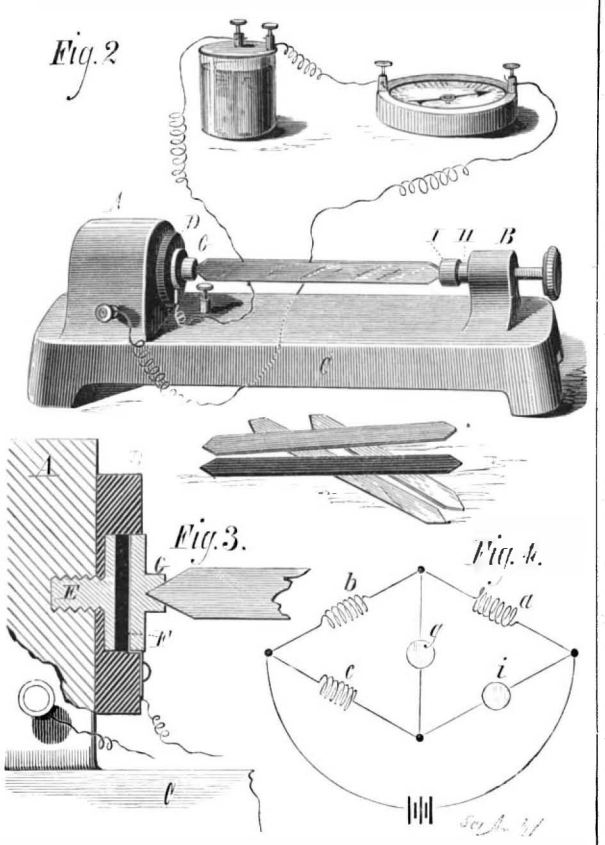
The micro-tasimeter is represented in perspective in Figs. 1 and 2, in section in Fig. 3, and the plan upon which it is arranged in the electric circuit is shown in Fig. 4.

The instrument consists essentially in a rigid iron frame for holding the carbon button, which is placed between two platinum surfaces, one of which is fixed and the other movable, and in a device for holding the object to be tested, so that the pressure resulting from the expansion of the object acts upon the carbon button.

Two stout posts, A, B, project from the rigid base piece, C. A vulcanite disk, D, is secured to the post, A, by the platinum-headed screw, E, the head of which rests in the bottom of a shallow circular cavity in the center of the disk. In this cavity, and in contact with the head of the screw, E, the carbon button, F, is placed. Upon the outer face of the button there is a disk of platinum foil, which is in electrical communication with the battery. A metallic cup, G, is placed in contact with the platinum disk to receive one end of the strip of whatever material is employed to operate the instrument.

The post, B, is about four inches from the post, A, and contains a screw-acted follower, H, that carries a cup, I, between which and the cup, G, is placed a strip of any substance whose expansibility it is desired to exhibit. The post, A, is in electrical communication with a galvanometer, and the galvanometer is connected with the battery. The strip of the substance to be tested is put under a small initial pressure, which deflects the galvanometer needle a few degrees from the neutral point. When the needle comes to rest, its position is noted. The slightest subsequent expansion or contraction of the strip will be indicated by the movement of the galvanometer needle. A thin strip of hard rubber, placed in the instrument, exhibits extreme sensitiveness, being expanded by heat from the hand, so as to move through several degrees the needle of a very ordinary galvanometer, which is not affected in the slightest degree by a thermopile facing and near a red hot iron. The hand, in this experiment, is held a few inches from the rubber strip. A strip of mica is sensibly affected by the heat of the hand, and a strip of gelatin, placed in the instrument, is instantly expanded by moisture from a dampened piece of paper held two or three inches away.

For these experiments the instrument is arranged as in Fig. 2, but for more delicate operations it is connected with a Thomson's reflecting galvanometer, and the current is regulated by a Wheatstone's bridge and a rheostat, so that the resistance on both sides of the galvanometer is equal, and the light-pencil from the reflector falls on 0° of the scale. This arrangement is shown in Fig. 1, and the principle is illustrated by the diagram, Fig. 4. Here the galvanometer is at *g*, and the instrument which is at *i* is adjusted, say, for example, to ten ohms resistance. At *a*, *b*, and *c* the resistance is the same. An increase or diminution of the pressure on the carbon button by an infinitesimal expansion or contraction of the substance under test is indicated on the scale of the galvanometer.

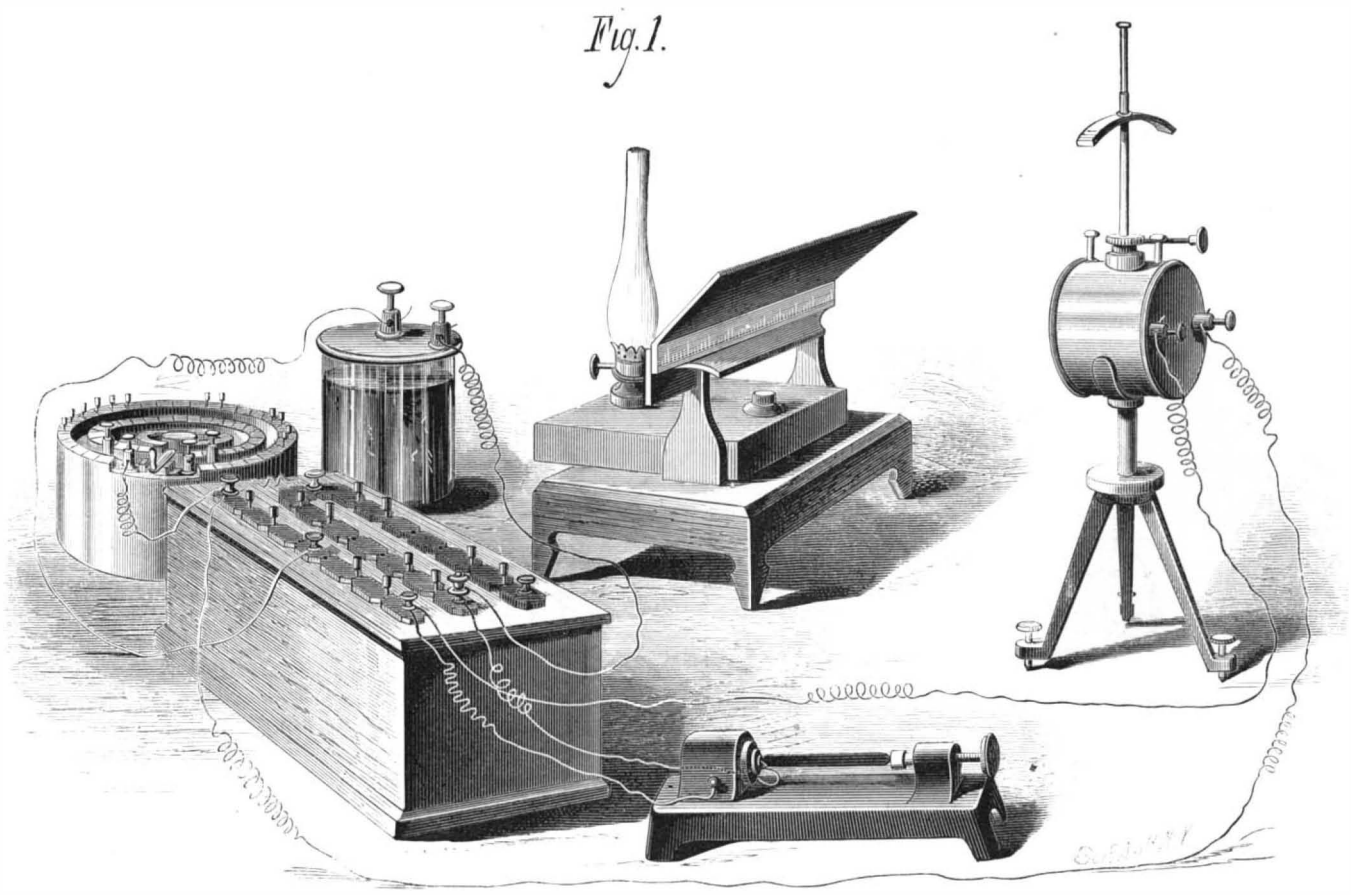


The carbon button may be compared to a valve, for, when it is compressed in the slightest degree, its electrical conductivity is increased, and when it is allowed to expand it partly loses its conducting power.

The heat from the hand, held 6 or 8 inches from a strip of vulcanite placed in the instrument—when arranged as last described—is sufficient to deflect the galvanometer mirror so as to throw the light-beam completely off the scale. A cold body placed near the vulcanite strip will carry the light-beam in the opposite direction.

Pressure that is inappreciable and undiscoverable by other means is distinctly indicated by this instrument.

Professor Edison proposes to make application of the principle of this instrument to numberless purposes, among which are delicate thermometers, barometers, and hygrometers. He expects to indicate the heat of the stars and to weigh the light of the sun.



EDISON'S MICRO-TASIMETER.

NOTE BY PROFESSOR EDISON.

The heat measurer was described and experiments shown to Professor Langley, the well known astronomer of the Alleghany Observatory, some six months ago. On his suggestion at the time, that it ought to be worked up as a very valuable boon to science, especially in the line he was investigating (that is, measuring the heat of the stellar spectra), I tried many experiments with it and devised the form given. This apparatus was described to various members of the National Academy of Sciences, held at Washington, April 17, 18, and 19, 1878, and the Washington *Star* and *Union* newspapers published then gave a description of the instrument. Copies of these papers were at once mailed to William H. Preece, Professor Scheelen, Count Du Moncel, and other physicists in Europe.

A River Reversed.

A natural river begins in countless little runlets, which unite in a network of larger streams, to unite in their turn in still larger ones, until a strong current receives the united flow from all. The sunless stream that supplies a great city, like New York, reverses all this. It begins at a single stream and ends at a million outlets. The network of pipes through which the Croton is delivered aggregates a length of 440 miles, and the daily flow averages 85,000,000 gallons.

GOOD WORK FROM CHEAP PATENTS.

It is not long since a prominent Englishman urged as an objection to cheap patents the comical plea that they gave an unnatural impulse to the inventive faculty, thereby fostering a preference for mere cleverness over honest work. As an awful example he pointed to the United States, "where the factitious value attached to inventions has tended to produce an almost total sacrifice of solid workmanship to flimsy ingenuity." A very pretty comment on this charge may be found in the explanation given in the leading English papers of the secret of the dangerous character of American competition in cottons and other manufactures. The danger lies, they admit, not so much in the cheapness of American goods as in their superior quality and finish. Where they are known, American cottons are preferred to those of England in the great markets of the East, even at a higher price, because they are honestly made. The *Saturday Review* attributes the decline and threatened loss of England's trade in the East as much to "the fraudulent folly of English manufacturers, who have lost their customers by palming off on them adulterated goods," as to the natural advantages of American manufacturers. In like manner the London *Times* attributes the increase of American manufactures, and their successful competition with those of England, to their superiority as well as to genuine domestic advantages in the processes of manufacture. A Swiss commissioner to the Philadelphia Exhibition writes to his countrymen: "Have you ever compared a rake, a spade, a knife, a hatchet, made in America, with tools made here? How much is Europe left behind! While our constructors aim generally at products heavy, massive, solid, in appearance, and save rather in the quality of the metal than on the weight, American workmanship is light, pleasing to the eye, and employs almost exclusively good material."

At the exposition of objects of art at Munich there was nothing in cast iron which could be compared with a stove which he had brought from America. "Not merely for the good quality of the casting, but also in the ornamentation." Again, he says: "Who does not know American sewing machines? And who has not already become satisfied, even when machines of the same kind are made in Europe in enormous quantities, that the somewhat higher price of the American machines is largely compensated for by their construction, their solidity, and their convenience?" So far from finding in American products any sacrifice of solid workmanship to flimsy ingenuity, this critical observer pronounces them generally "handsome, solid, practical, light, and of good material," and the verdict of buyers, the world over, confirms his testimony.

NEW WHEEL TIRE.—A new wheel tire has been recently invented. It consists in passing around the usual iron tire a rubber tire, and around this again an iron tire made in sections, so that each section may yield inward as the weight comes upon it. It is said to lessen noise, jarring, and wear.

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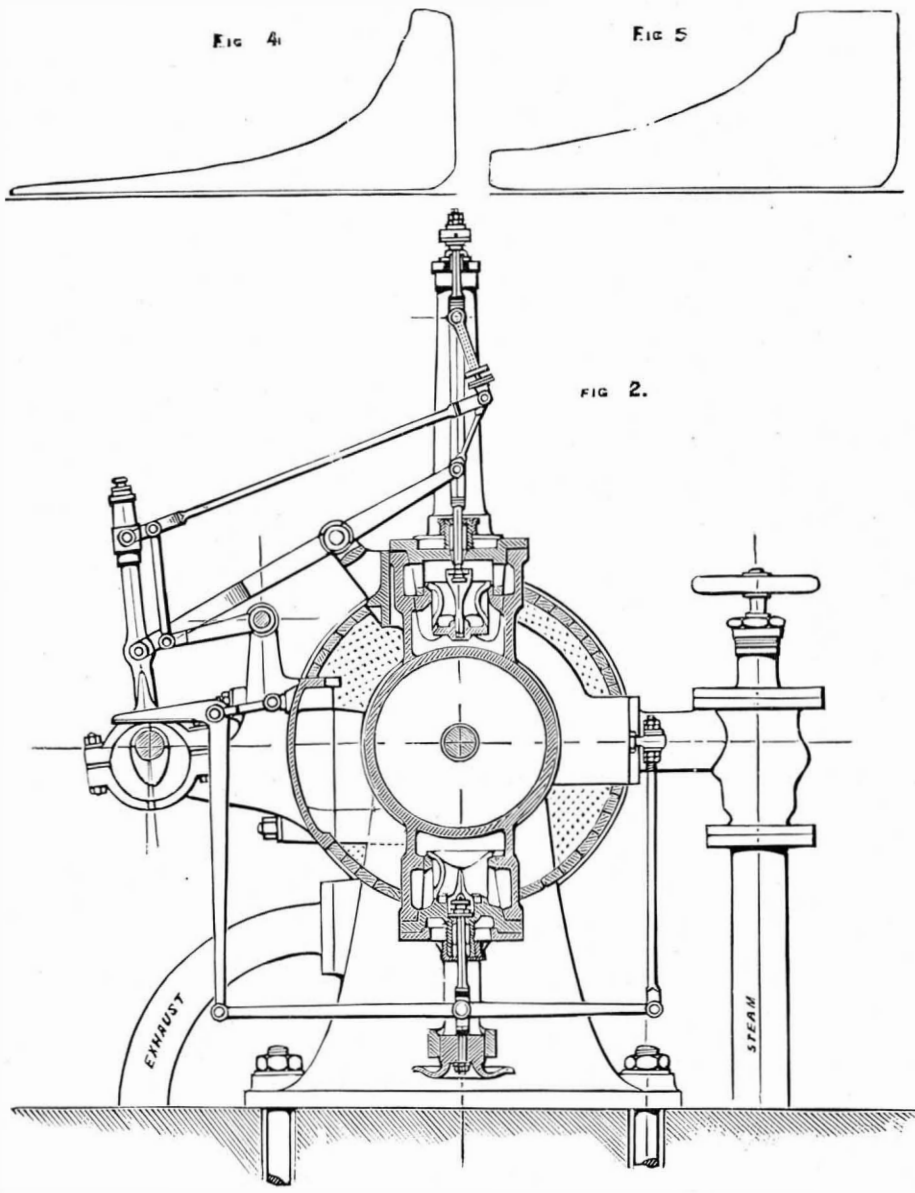
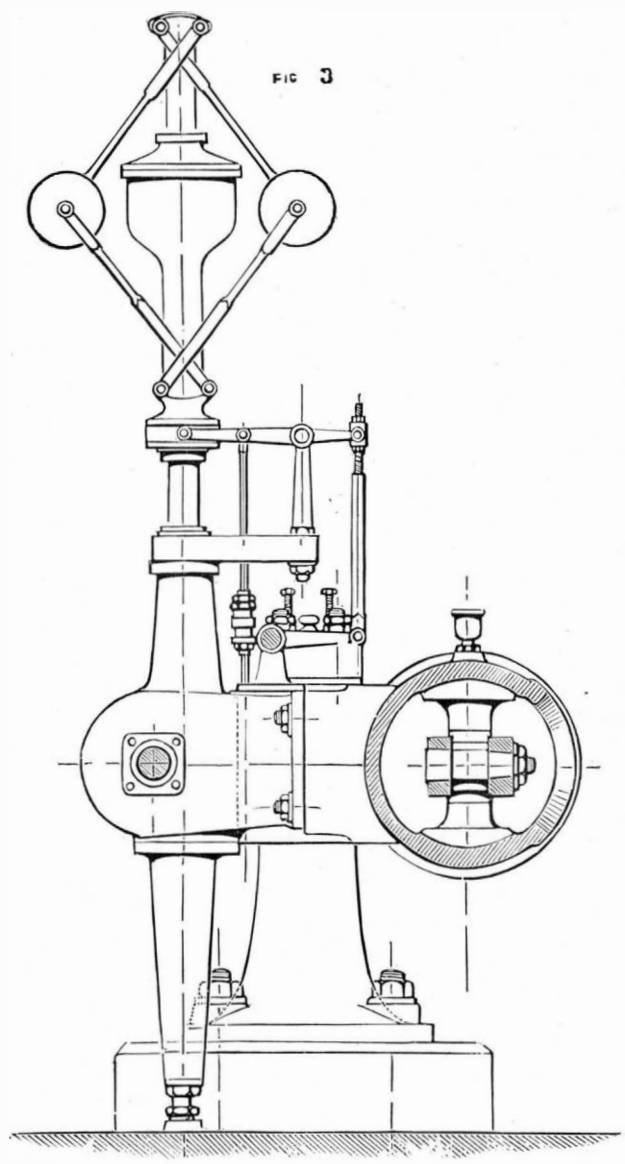
COLLMANN'S VALVE GEAR.

We illustrate on this page a system of valve gear, recently invented by Herr A. Collmann, of Vienna, which, in certain points, resembles the well known Corliss and Sulzer gears. In our engravings (which we copy from *Engineering*), Fig. 1 is a perspective view, taken from a photograph of a horizontal engine fitted with the Collmann gear; Figs. 2 and 3 are sections through the cylinder and the guides respectively; Figs. 4 and 5 are copies of indicator diagrams taken from the engine shown in Fig. 1. Double beat valves are used, two for admission on the top of the cylinder, and two for exhaust below it. All four valves are worked from a horizontal shaft parallel to the axis of the cylinder, driven from the crank shaft by miter gearing. The governor (Figs. 1 and 3), of an approximately isochronous type, is driven from this shaft through a pair of screw wheels. The exhaust valves are worked by cams through an arrangement of lever shown plainly in Fig. 2. These valves are lifted by the cams and allowed to drop shut by their own weight, and that of the levers and rods connected with them.

The mode of working the steam valves is, however, the characteristic feature of this gear. Referring to Figs. 1 and 2, it will be noticed that on the auxiliary shaft there are two eccentrics, one for each valve. A pin in the eccentric rod is jointed directly to one end of a lever working on a horizontal axis fixed to the cylinder. The other end of the same lever is connected by a light link to the lower end of a little buffer rod working in a socket which is itself jointed above directly to the valve spindle. The pin on the buffer rod is connected by a long link to a block capable of sliding on the upper end of the eccentric rod, which is made cylindrical for that purpose. Suppose this block to be fixed on the eccentric rod, and the eccentric to be in position to commence opening the valve. The eccentric is then nearly horizontal and turned towards the cylinder, so that the upper part of the rod is at its maximum distance from the cylinder. The buffer rod and the link below it, which together form, as will be seen, a knee joint, are nearly in one vertical line, the joint between them being pulled forward by its connection with the eccentric rod. The flange on the lower end of the socket rests on the buffer plate (which is covered with leather), and as the eccentric descends the latter is lifted (by the action of the lever), and the valve is thereby opened. As the eccentric descends the valve receives a motion determined jointly by the motions of the eccentric and its rod. The former by itself would lift the valve; the upper end of the rod, however, comes continually nearer the cylinder, and by so doing pushes away the lower end of the buffer rod, a motion which would, by itself, tend always to leave the valve free to drop shut again. The particular point at which the valve does actually close will depend upon the position of the sliding block on the eccentric rod. The higher this is the greater will its motion be, the further will the knee be pushed out for any given position of the eccentric, and the earlier, therefore, will the cut-off take place. To make the change of cut-off automatic it is only necessary to control the position of the block on the eccentric rod by the governor, and this is done by the arrangement of levers shown in the engravings.





SECTION THROUGH CYLINDER. SECTION THROUGH GUIDES.

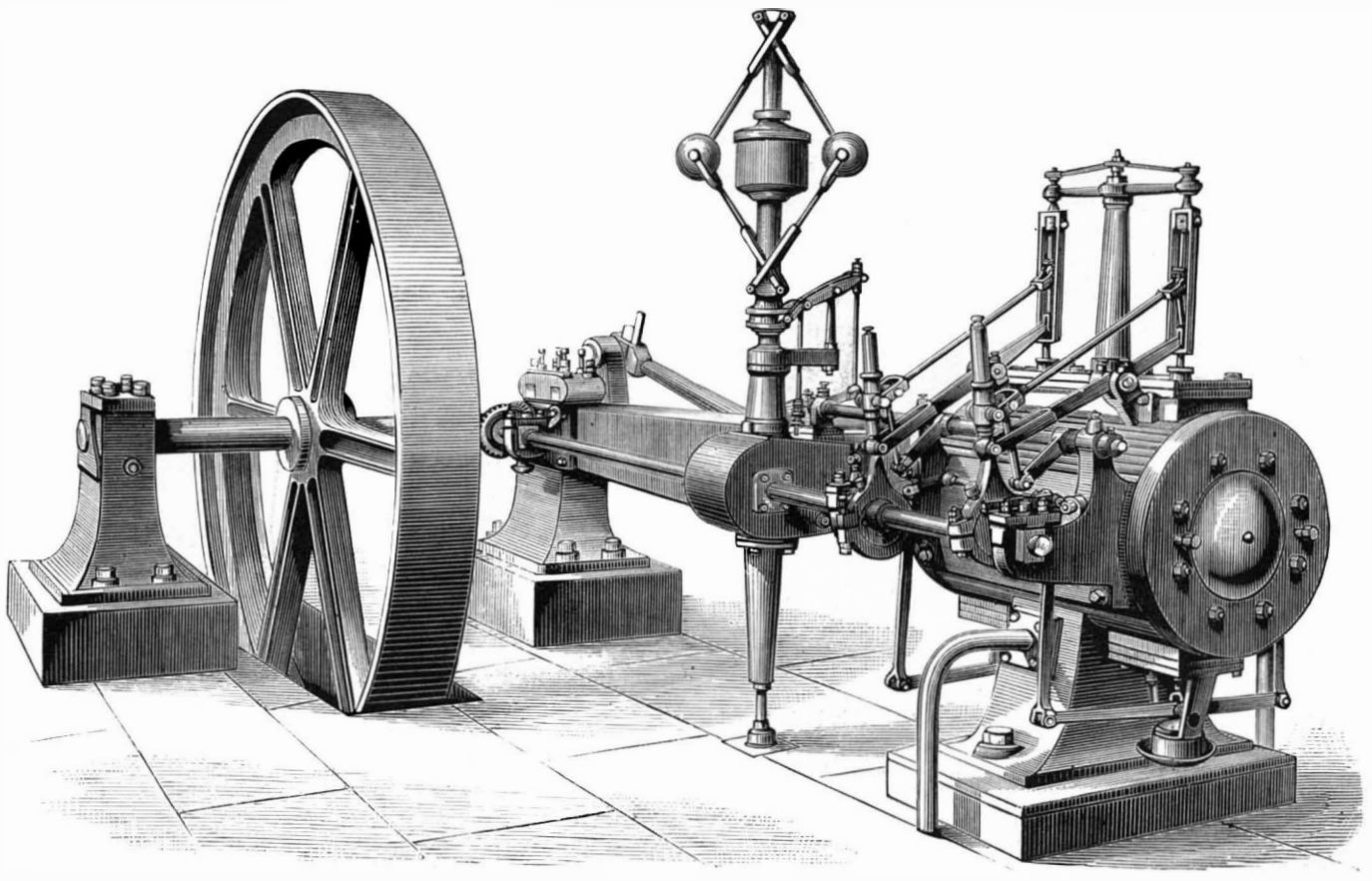


Fig. 1.—HORIZONTAL ENGINE WITH COLLMANN'S VALVE GEAR.

New Industries.

Within the past few years a great number of new industrial operations have been established in the United States, from which have come two very important results—the employment of labor saving machinery in a cheaper, more rapid production, and the incitement to the greater activity in improvement and invention of appliances. With the fact accomplished that one machine can do the work of

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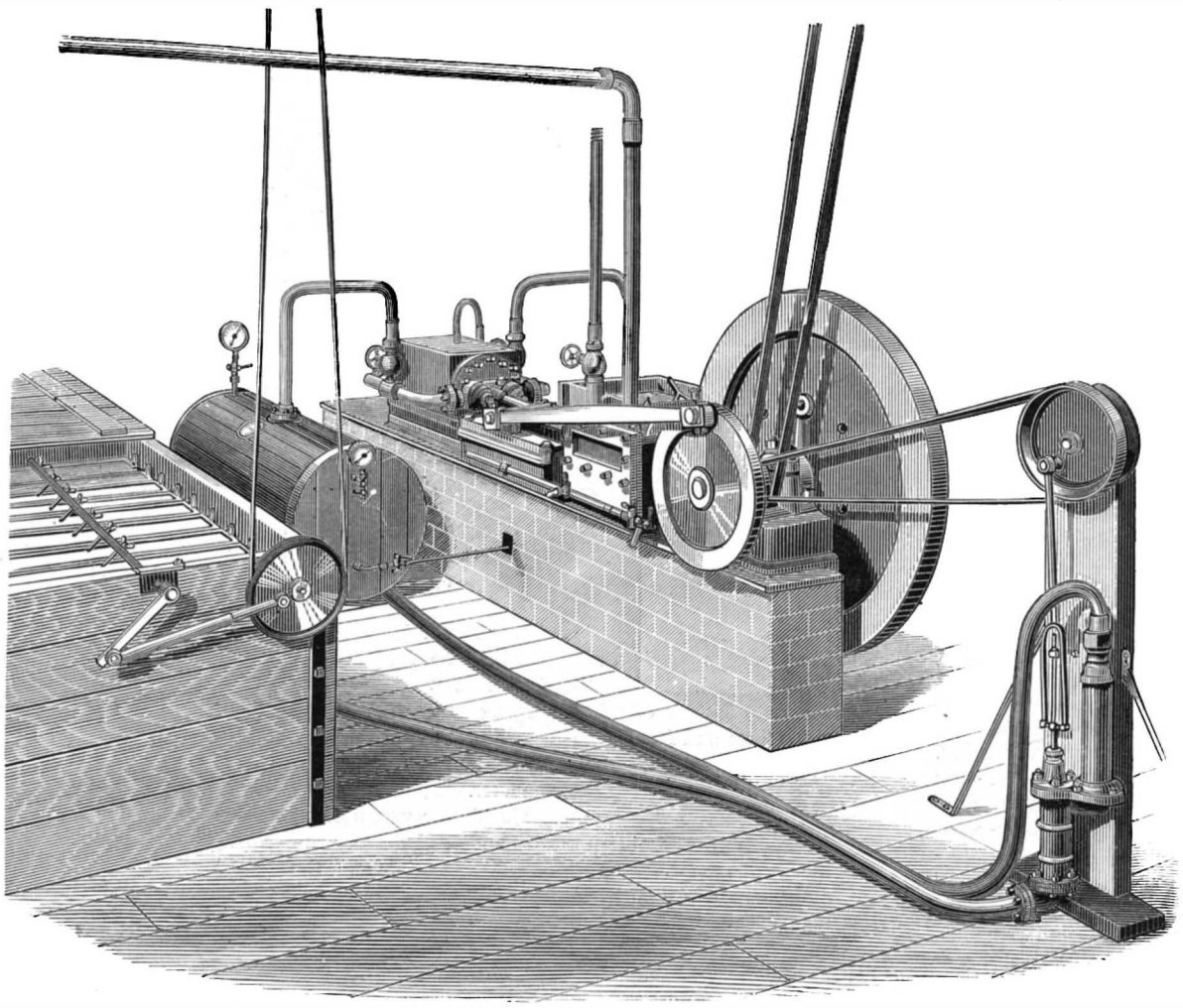
a dozen men, we see the evil of something worse than convict and Chinese cheap labor in our midst. We have an enormous addition to our population in the shape of automatic labor-saving machines. If one superintendent can take care of ten or twenty men, so here one man can take care of a half dozen machines doing each ten men's work. The machines have the advantage that they cost nothing for provisions—slaves unfed, unclothed, and harnessed down for life, breathing steam and living on fire.

While there is such an enormous increase in the power of production, with no increase in the demand for consumption, it is necessary that much invention and effort should be at work to increase the industrial employment of the people, and to increase the wants and requirements of a higher civilization now rendered feasible. While our people are thus thrown out of one employment, another should be offered. It is a fixed law that every citizen should have what he pays for—all the benefits and opportunities which the nation has power to bestow. Employment is the first right of man; traffic, pleasure, or associations resulting from labor are secondary considerations. To have employment the people of the United States should be engaged in producing everything which the world produces, not incompatible with climate or nature. A close observer of the industrial economy of Germany, France, and Great Britain finds such a number of profitable industries there existing, and of which America has no knowledge, and for the productions of which we pay our money, as would give every person in America steady employment. The care of the United States should be, while affording an asylum to the over-crowded population of other nations, to enable them to bring their industries with them.

AN ETHER ICE-MAKING MACHINE.

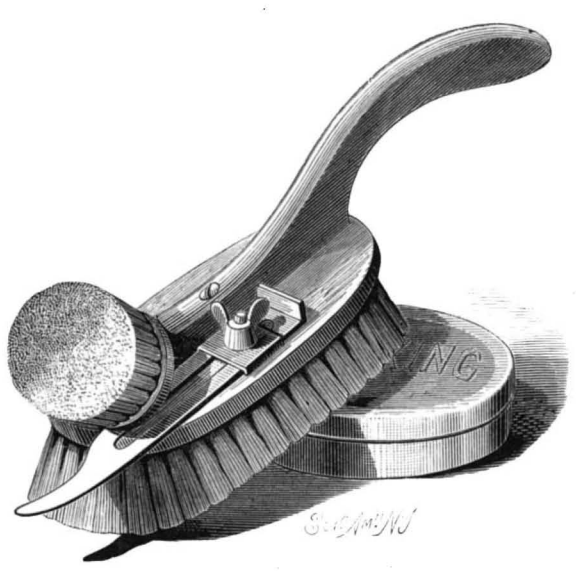
The machine shown in the accompanying illustration is one made by Messrs. Duvallon & Lloyd, of Birmingham, England. It uses ether, and the apparatus consists of an engine and air pump combined on the same bed plate, a refrigerator, an ether condenser, a circulating pump, and one or more ice boxes, according to the quantity of ice required. In the machine illustrated the air pump is 9¼ inches in diameter, driven direct by a steam engine, with 7½ inch cylinders, the stroke being 21 inches. The two cylinders are arranged in line, the two piston rods being cottered to the crosshead. The guides consist of hollow angle pieces working on the corners of the square bars. The air pump is double-acting. The connecting rods, one at each side of the cylinder, work on crank pins inserted in disks keyed on to the main shaft, one of these disks being of considerable weight, so as to act as a fly wheel. In the center of the main shaft is a pulley for driving overhead shafting, from which the circulating pump and the agitator derive their motion. The two inlet passages of the air pump, one at each end, are connected by a copper pipe, from which branches another copper pipe, placing them in communication with the refrigerator. This is a cylindrical vessel, similar in construction to a multitubular boiler, covered with felt and lagged with wood; the tubes are made of copper and riveted to brass end plates. On the other side of the air pump, the two outlet valves, connected in the same manner as the inlet valves, are placed in communication with the ether condenser, which is similar in construction to the refrigerator, but is of rectangular section and has no copper shell. The tubes communicate at each end with metal chambers, one of them acting as a receptacle for the air which finds its way inside the condenser. The whole is immersed in a tank of wood or galvanized iron, through which a constant stream of water is made to pass for cooling and condensing the vapor of ether. A vacuum of about 25¼ inches, it is stated by *Iron*, from which we obtain these particulars, is maintained by the air pump in the refrigerator, vaporizing the ether at a low temperature. The absorption of heat due to this operation lowers the temperature of the strong brine, made to circulate, by means of the pump provided for that purpose, through the tubes and the ice box. The latter is a tank of red deal, varnished inside, with partitions having holes bored in them for allowing the brine to circulate slowly. Between the partitions are suspended zinc moulds of rhombic form, varying in width according to the shape of the blocks of ice required, and filled with pure water.



ETHER ICE-MAKING MACHINE.

IMPROVED SHOE BRUSH.

Mr. Frank H. Kean, of Cincinnati, Ohio, has added a useful attachment to blacking brushes, in the shape of an adjustable scraper knife, by which hardened mud, etc., may be easily removed from the shoe. The arrangement of the device is perfectly plain from our engraving. It will be noticed that the knife is curved at its front end, and that by the thumb nut it may be clamped so as to project as much as desired. This device was patented April 30, 1878.



IMPROVED SHOE BRUSH.

Burns and Scalds.

Dr. G. F. Waters, of Boston, Mass., author of the alkaline treatment, now so widely known for its remarkable success, says:

"My treatment is to apply to the burned surface bicarbonate of soda, if it is a wet surface, in fine powder; but if is a dry burn, use a paste of bicarbonate of soda and water, or a strong solution of the bicarbonate of soda in water, and apply to the burned surface. This relieves sunburns as well as burns from hot coals, melted sulphur, hot iron, steam, etc.

"Always dispose the burned surface so that the blood can gravitate toward the heart if possible, as otherwise a continuous pain may be felt, due to the dilatation of the blood vessels from the weight of the contained blood.

"If bicarbonate of soda is not at hand, bicarbonate of potash is the next best; biborate of soda does as well, but is not often found handy. Then the emulsion of lime water with oils makes a good dressing where the skin is broken. But vaseline is preferable, as there is no odor from it and it is quite as bland."

FIFTY thousand dozen of American hay rakes, says a writer in the *Sheffield Daily Telegraph*, have been ordered and partly received by a single firm in Sheffield for this season's demand only.

New Inventions.

Mr. W. C. Phillips, of Norwalk, Conn., has invented an improved Stair Fire Escape, made in parts, the number of which in use is determined by the height of the point to be reached, each part consisting of hinged sections capable of being locked in line or at angles by means of bolts operated by cords, suitably braced and capable of a variety of adjustment.

An improved Ice Pitcher, invented by Mr. H. B. Beach, of West Meriden, Conn., has an interior china, glass, or other suitable lining, strengthened by a metallic layer spun around it, and secured to the body of the pitcher by a screw bolt and nut at the bottom. While the usual air space about the bowl is left, the strengthening obviates the danger of cracking the lining by dropping lumps of ice upon it or in case of falling.

Mr. A. R. Sherman, of Natick, R. I., has patented a convenient Book Rack for church pews, in which a number of improvements are introduced, designed to hold the books shut, and also adjustable to hold small books in place.

Mr. H. S. Cate, of Millerstown, Pa., is the inventor of an improved adjustable and removable rubber Packing for Oil Wells, which is attached to the casing head, surrounding the tubing or cable, for the purpose of preserving the vacuum or controlling flowing oil or gas while withdrawing tubing or drilling.

Mr. J. R. Pierce, of Orfordville, N. H., has patented a Horseshoe Spring which is claimed to spread the hoof of a horse's foot without injury and without affecting the attachment of the shoe. The spring is V-shaped, pivoted at its angle to the toe of the shoe, and so formed that its arms extend back along the sides of the frog and bear against the inner sides of the rim of the hoof, at its heel.

Mr. Emerson Cole, of Brooklyn, N. Y., has patented an improved Bung Fastener, made of a tapering pointed strip of sheet metal, having near its wider end burrs, which enter the sides of the bung hole as the bung is driven in with the fastener between it and the hole. The fastener is also made in convenient form to bend over the bung after it is driven in.

An improved Sled, the invention of Mr. R. Armstrong, of Portland, New Brunswick, is so constructed that each runner is allowed sufficient mobility to pass over inequalities of road without disturbing the position of its fellow to any material extent.

In an improved Cooking Stove, patented by Mr. H. R. Smith, of Minnesota Lake, Minn., the arrangement is adaptable to burning hay as well as wood or coal, mainly for the purpose of utilizing the cheap hay crops of the Western States, after the hay is properly prepared or baled for the purpose.

An improved Oil Well Torpedo, invented by Mr. W. Haus, of Church P. O., Pa., consists of an interior exploding shell and an exterior case filled with a sawdust or paper mixture. The object is to furnish means for exploding the torpedo in case the regular caps fail, without drawing it out of the well; and to this end a supplementary exploder, with capped rods and a second anvil, operated by dropping a weight from above, are provided.

In a new Iron Fence the inventor, Mr. A. Zimmerer, of Nebraska City, Neb., provides the lower ends of each fence post with a screw thread corresponding with a screw hole in a metallic base plate attached to a block set firmly in the earth. Each post is notched at its upper end, and the top rails have oblong slots, so that the rails may be secured to the posts by inserting the ends through the slots and then turning the posts in their screw sockets.

Mr. J. Gallaspie, of Russiaville, Ind., has patented an improved Trace Holder, constructed with a view to keeping the traces straight and preventing them from swinging about when slack. It is formed of two pieces, hinged together at their lower ends, notched upon their inner sides to allow a space for receiving the trace, and secured to each other by a thumb-screw at the upper end of the smaller part. An eye in the upper end of the longer part receives a supporting strap, which is secured to the hip strap of the harness.

A Rainwater Filter, designed to filter the water passing from a roof to a cistern, has been patented by Messrs. W. H. Thomas and T. H. Carter, of Mount Sterling, Ky.

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Freezing in winter is avoided by the automatic draining off of the water in the filter as soon as the supply from the roof ceases; but it is closed again, so as to cause the water to pass through the filtering material, as soon as water is supplied from the roof.

Interesting Electrical and Magnetic Experiments.

At a recent evening lecture at the Royal Institution, London, a discourse was delivered by Sir William Thomson, Dr. Siemens being in the chair. The subject was "The Effects of Stress on the Magnetization of Iron, Cobalt, and Nickel." Sir William first pointed out that certain magnetic bodies possessed the power of retaining magnetism in a greater degree than others, iron possessing this force in a high, and nickel and cobalt in a lesser degree; paramagnetic bodies do not possess this power.

The magnetic property in bodies might be different in different directions; that is, it varied according to the structure of the body. Some bodies could be isotropic; that is, their magnetic properties might be the same in all parts of their mass; thus, a lump of dough, when uniformly kneaded and placed between the poles of a powerful magnet, was unaffected; but when compressed in one direction, became influenced by the magnetism.

The influence of the magnetism of the earth on a bar of soft iron was next pointed out, the bar becoming magnetic when held in the line of the dipping needle, the upper end of the bar always taking the same magnetism, even when the ends were reversed, after the bar had been held in one direction.

One interesting experiment consisted in inverting a bar of iron, part of the weathercock of Oxford Cathedral, which had stood upright in the steeple for over 300 years, and had been carefully treasured by Faraday in the same position, with the same end up, ever since. It would have been a scientific sacrilege to have done so idly, but the object was to see whether, after three centuries of fixity in position, it had acquired a fixity of magnetization. No one had a better right to perform the act than the philosopher to whom Faraday has handed on the lamp, and no one could have done it with more reverence. The result could not be predicted, and it was awaited with considerable interest. Before inversion, the upper end of the bar was a true north pole by virtue of its position, and the lower end a true south pole. After inversion, the latter became a true north pole, and the former upper end a true south pole, showing that the magnetic induction of 300 years had not taken a permanent hold upon the iron.

The effect of striking a bar of iron, cobalt, or nickel, held in the line of the dipping needle, was shown to give a very perceptible amount of magnetism to them, even when the blows were very slight.

It was pointed out that this effect was very much more considerable in long than in short bars, and that therefore it was advisable to avoid the use of such bars, long in proportion to their breadth, for stanchions in ships, as compass errors might become considerable from the magnetism which such bars might acquire.

Villari's discovery was next alluded to, namely, that the effect of stretching a magnetized wire was to increase its magnetism, this increase reaching a maximum at a certain point, and then decreasing as the strain was still further increased. On the relaxation of the strain the magnetic condition of the wire was nearly, but not quite, restored to its normal power.

Sir William had extended these experiments by determining the effect of transverse strains such as is produced by applying hydraulic pressure in an iron tube; this transverse strain was found to decrease the magnetic force in the tube when the magnetic power was feeble, a maximum being reached at a certain strain; when the magnetism was strong the opposite effect was produced, a transverse strain producing an increased effect, rising to a maximum at a certain strain.

The effect of torsion on a wire was found to be to decrease the magnetic power in a wire, no matter which way the twist was made; but on the relaxation of the twist, the magnetic power remaining in the wire was less than it was at first.

In conclusion, says the *Telegraphic Journal*, Sir William said that the values of the discoveries did not necessarily lie in their immediate practical application, but in the fact that every new law brought to light added a link to the chain of human knowledge, and must be a gain to mankind.

The Annual Soirée of the Royal Society was held at the society's rooms in Burlington House on the 1st of May. A large and distinguished company was present. Among the objects exhibited, those of an electrical nature came in for a fair share of notice. The Telephone Company exhibited various forms of apparatus; the "telephone harp," of Mr. F. A. Gower, being the most prominent instrument. This invention enables some of the sonorous properties of the telephone to be rendered perfectly audible to a large audience. The telephone being a most unsatisfactory instrument for audible demonstration to a large audience, the harp of Mr. Gower will prove very useful for keeping up the interest of lectures on the subject.

Mr. Henry Edmunds exhibited his method of showing variations in the pitch of sonorous vibrations by means of a revolving vacuum tube.

Mr. Robert Sabine exhibited his discovery of the effect of light on selenium in generating an electro-motive force.

Mr. Ladd exhibited a large Holtz electrical machine, and specimens of Byrne's American pneumatic battery, lately illustrated in the SCIENTIFIC AMERICAN.

Messrs. Siemens Bros. exhibited one of their dynamo-electric machines capable of giving an electric light equal to 1,200 normal sperm candles; an electric lamp was also shown by the same firm.

Among the other scientific apparatus, the Edison "phonograph" was shown in action by Mr. Stroh, and explained in a short lecture by Mr. W. H. Preece.

The "mechanical chameleon," the invention of Mr. A. B. Kempe, excited much interest among the more scientific portion of the visitors. This ingenious apparatus, by mechanical means, enables all the gradations of tint of any two colors to be obtained and to be varied at will, the one tint dissolving gradually or suddenly into any other, or remaining stationary if required.

Mr. Francis Galton, F.R.S., exhibited a curious optical instrument, by which portraits of different persons could be combined so as to form a new face possessing the characteristics of each individual portrait.

Mr. Nathaniel Holmes showed in action his flashing light signal apparatus, in which a brilliant "flare" is produced by the action of water dropping on phosphuret of lime.

Communications.

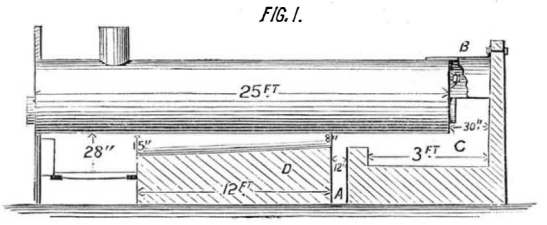
Setting Boilers.

To the Editor of the Scientific American:

Some years since I took charge of a sugar plantation on the Spanish Main, S. A. Four hundred tons of coal (when it could be procured) and about three hundred cords of wood were consumed every season. I had not time to make any changes the first season, but although the average was increased I decreased the coal bill eighty tons and the wood bill one hundred cords. The second year I made the changes below described in boiler settings, and consumed two hundred tons of coal and one hundred and forty cords of wood. I burned all the bagass.

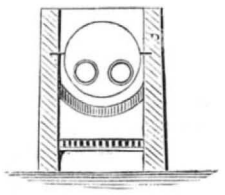
The boilers were three in number, twenty-five feet between

FIG. 1.



heads, four feet diameter, each containing two twelve-inch flues. The old settings were of tiles and stone, sixteen square feet of grate surface for each one, and were in independent settings. There were two bridge walls straight across, one at the back end of the grates, the other at the back end of the boiler. The boiler was eighteen inches above the bridge walls. The space between the bridge walls was about four feet deep and vacant. The alteration consisted in making a bridge wall twelve feet wide on a circle with the boiler, the front end fifteen inches therefrom, and the back end eight inches below the boiler, like part of a conical tube, shown at D, Fig. 1. Back of this wall a straight wall was placed, between which and the former was left a space 12 inches wide, and on each side of which was placed a door with a register, A, of four square inches, for the admission of air. Back of the last wall was constructed the combustion chamber, C. B is a bonnet of boiler iron; P, Fig. 2, cast iron plates. The masonry was not in contact with the boilers.

FIG. 2.



The grate surface was increased for each boiler from sixteen to 20·5 square feet by putting in bars five feet long in place of four foot bars taken out. My method of firing was as follows: Our coal was usually about one third slack. Coarse coal sufficient to make a good fire was separated from the dust with rakes, and after a good fire was obtained, bagass or wood was thrown on, followed by a light but frequent firing of slack coal. Before the alterations were made we made a great quantity of ashes, lodging under the boilers and in the flues and front bonnet. After this no ashes of any account were made, but a small amount of fine whitish dust collected in the combustion chamber. The heat in the combustion chamber was intense. No blower was used at any time. The fires were run down and hauled every run and new fires made. Everything which came from the furnaces and ash pits was screened, and whatever passed through a No. 8 screen was thrown away. No coal dust of any account passed through the grates. This method of boiler setting is not patented, as far as I know.

Bangor, Me. FRANK B. CORT.

Driving Piles in Sand.

To the Editor of the Scientific American:

Referring to the communication of F. L. James, M.D., in the SCIENTIFIC AMERICAN of June 1, 1878, page 340, permit me to give my experience.

Some 30 years ago I made a contract with the United States Government to build a granite basin at the Pensacola navy yard, which required the driving of about 3,000 piles, to the depth of from 30 to 40 feet, in the hard, sharp sand at that yard.

After signing my contract, I was informed by the then Chief Engineer of the Navy Department that a corps of engineers had tried the experiment of driving piles at that yard, and that the maximum depth to which they could possibly be driven was 15 feet; at that depth the heads of the piles were boomed up, though banded with iron hoops, and that the hammer rebounded without moving the pile.

I inquired how heavy a hammer had been used, and was informed that it weighed 1 ton; it struck me at once that it was like trying to drive a 6 inch spike with a tack hammer instead of using an 8 lb. maul.

I obtained hammers weighing two tons and a half, and allowed them to fall but 12 feet: the result was that I drove my 3,000 piles without banding the heads, the effect of the blow being to polish the heads of the piles.

If you will publish the above it will be of more benefit to the practical mechanic than the long article on the same subject illustrated by letters, figures, and hieroglyphics which I recently saw in a scientific magazine.

New York, May 23. JOHN S. GILBERT.

HUGHES' MICROPHONE AN ALLEGED PIRACY.

Mr. Thomas A. Edison sends us a communication in which he points out in some detail that Professor Hughes' microphone is a piracy on his carbon telephone, which, it will be remembered, is based on the great changes of resistance to the electrical current which occur in carbon under minute pressures. We illustrated both of these inventions in our issue of June 8, 1878, and at the same time pointed out the close similarity between them. Mr. Edison states that Hughes' discovery is not merely identical with his, but that the correspondence continues down to the minutiæ which many who concede the similarity of the investigations in other respects believe to constitute a distinctive feature in favor of Hughes. Mr. Edison says that "the subdivision of carbon has been repeatedly tested by me in my experiments on the telephone," and that he has employed the metallization of the carbon by plunging it in mercury for many years past. The change of electrical resistance with enormous rapidity by plumbago under pressure was published, as we have previously stated, in this journal on July 28, 1877, and we have already pointed out a fact dwelt upon by Mr. Edison in his present letter, namely, that Edison some time since abolished the vibrating plate in the carbon telephone, substituting a solid plate, and thus removing the last possible distinctive difference between the completed form of his device and the same form of the pirated microphone of Hughes.

It is not necessary to dwell on these points, because they are very few and simple, and the reader can review them by turning back to the illustrated description, above referred to, of the devices of both Hughes and Edison. The more interesting part of Mr. Edison's letter is its conclusion, wherein he implicates Mr. William H. Preece, the coadjutor of Professor Hughes, in introducing the microphone.

Mr. Preece is electrician to the London Post Office, the author of several works on electrical subjects, and an expert of considerable ability in that line. In the early part of last year, Mr. Edison states in the letter before us, he came to this country and visited Mr. Edison at his laboratory. With that freedom which is characteristic of the man, Edison exhibited to him the experiments which he had under way, including those involving the carbon telephone. At Preece's expressed desire Edison made him his agent for the presentation of this telephone in England. Subsequently Preece was also charged with the introduction of the phonograph in that country, and thereafter Edison kept him fully advised of his advances, both by private letter and by mailing him published accounts. Among other journals sent to Preece was a copy of the Washington *Star*, of April 19 last, containing an account of Edison's modification of the carbon for measuring minute degrees of heat; and that this was received by Preece before the presentation of the microphone to the Royal Society is amply proved by the fact that that gentleman embodied an extract from the account in an address delivered, in May, before the London Society of Arts. This extreme sensitiveness to heat, it will be remembered, is claimed to be a special discovery of Hughes in relation to the microphone. It is somewhat remarkable besides, in view of the above, that the announcement of Hughes' observation of the capabilities of the microphone as a thermometer appears as an addendum to the *Engineer's* publication of the paper, read by Huxley, announcing the invention of the microphone to the Royal Society, and that our cotemporary stated that the discovery had been made by Hughes *since* the presentation of the communication by Huxley.

Mr. Edison says, in conclusion, that he considers the conduct of Mr. Preece, in this matter, "as not merely a violation of my own rights as an inventor, but as a gross infringement of the confidence obtained under the guise of friendship." Mr. Hughes' part, under this aspect of affairs, is inexplicable, and responses from both him and Mr. Preece, in answer to these charges, will be awaited with interest.

THE DIRECT CABLE DUPLEXED.—Dr. Muirhead has just successfully applied the duplex system to the direct cable between Torbay and Ireland, the longest line yet duplexed. Trial tests show an actual speed in working commercial messages of from seventeen to twenty words a minute, thereby doubling the capacity of the cable.

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THE TRICHINÆ IN SHAD.

BY JOHN MICHELS.

A mischievous report has been recently circulated by the public press, stating that shad of the present season were infested with trichinæ, one of the most disgusting and dangerous forms of human parasites.

Although the rumor was absurd and appeared to require no contradiction, those in the trade stated that the public were alarmed and the trade much affected. Thinking that a specific statement would be welcome, I made an investigation into the merits of the case, to discover what had given rise to this libel on a wholesome and delicious fish.

Fish in the New York market were carefully examined and large quantities of the offal searched; this was followed by a microscopical examination for more minute organisms. The same work was continued on the schooners, and both masters and men closely questioned on the subject.

The result showed the shad to be perfectly healthy, and free from any form of life that need cause any alarm. The key of the mystery is probably as follows: I found most fish, both large and small, troubled with a thread-like worm, in length about three quarters of an inch. They were met with in the gills and intestines of the large red snapper from the far South, and in small fish from the Bay of New York.

Having secured various specimens of these worms, they were prepared and mounted in the usual manner. Trichinæ are not visible to the ordinary vision, the cyst in which they lie coiled being 1-50 of an inch. So clearly these worms, three quarters of an inch long, were not trichinæ.

What were they? I should describe them as belonging to the order of free *Nematoideæ*, called *Anguillulæ*, which are found almost everywhere, and abound in surface mud of rivers, aquatic plants, etc., etc.

The marine species are considered perfectly harmless, and die shortly after desiccation. They probably enter the fish with the food, and are thus met with in the intestines and about the gills. Of course they are all removed when the fish are gutted and cleaned, and would be powerless for evil if they remained.

The *Nematoid* group is divided into two groups, the first including such formidable and well known human parasites as the celebrated trichina, the Guinea worm, and the *Ascaris lumbricoides*, and a host of more or less note; and secondly, of a class still more numerous, which are not parasitic at any period of their life, and lead a free existence. The worms recently observed by me belong to the second class, and never become encysted, and therefore can never be mistaken for trichinæ. Much interest is attached to the family of *Anguillulidæ*, which is known to include over 180 varieties; and numerous workers are in the field, among whom we may name Dr. Cobbold, of England, and our own Professor Leidy.

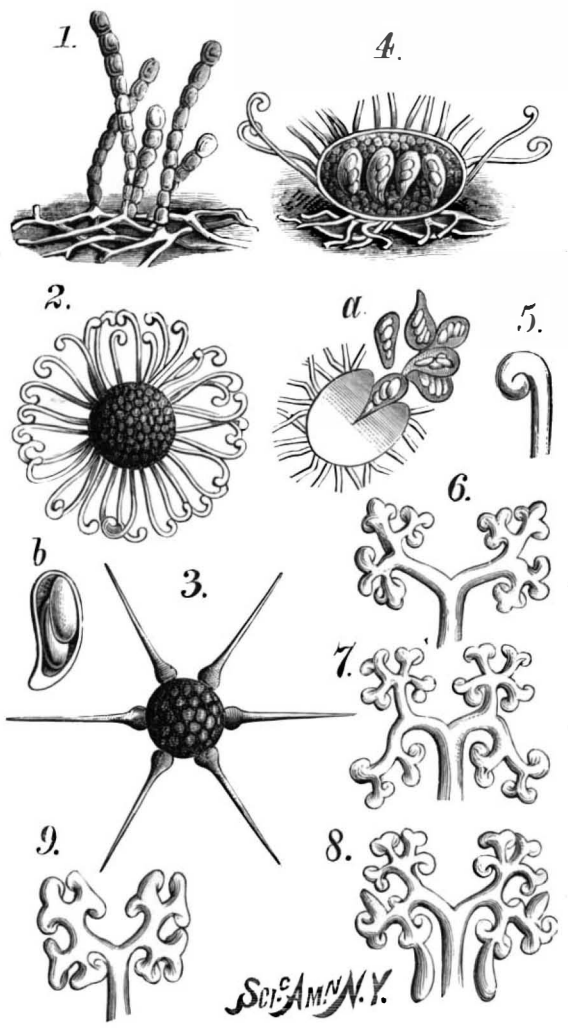
In regard to trichinæ, I may mention the fact that M. Colin confirmed the observations of Fuchs and Pagenstecher, that it is only in mammals that the trichinæ are enabled to pass into the muscular system and remain imbedded there, preserving their vitality. Such being the case, fish can always be eaten with perfect safety, so far as danger from trichinæ is concerned.

Composite Portraits.

At a recent meeting of the Anthropological Institute, London, Mr. Francis Galton, F.R.S., read a paper "On Composite Portraits, made by combining those of various Persons into a single Resultant Figure." The author remarked that when images of many different persons are successively thrown for a short time on the same portion of a sensitive photographic plate, the composite figure that results is found to have an unexpectedly good definition. No person who saw one of these composites for the first time would doubt its being the likeness of a real person, whereas it is no such thing; it represents the average of many. Of course the component images must all be in the same attitude and of the same size, but exactitude in these respects is unnecessary. The important requisite is that the images should be carefully superimposed, and this is a very easy matter to effect. The author begins by collecting photographs of persons of the same general type of features and taken in the same attitudes. These are reduced photographically to the same size. Then they are severally adjusted under fixed cross wires until one wire cuts the pupils of the eyes and the other bisects the interval between them. Then a hinged arm, carrying two points, is pressed down and pricks two register marks. When all the portraits have been thus prepared they are hung one in front of the other on two pins sticking out of a screen in front of the camera and passing through their register holes. They are photographed successively by removing one after the other to the last. Suppose there are ten component portraits, and that it would require 100 seconds exposure to get a satisfactory image of any one of them, then each of the ten portraits is exposed ten seconds only. The composite retains what is common to all the components, while individual peculiarities have in it no perceptible trace; the result is a handsome and regular face. Many specimens were exhibited. Even two faces will often make a fair combination, but the larger the number the better, if they all have the same general cast of features. The uses of the process are to procure anthropological types, to compare the average likeness of a family of brothers and sisters with that of their near ancestry—namely, two parents, four grandparents, and the uncles and aunts on both sides; and to obtain a good likeness of the same person by averaging many portraits. The author exhibited methods of optically combining portraits. A stereoscope will do this in some sense, but the best instrument for the purpose is a "double image prism" of Iceland spar.

MICROSCOPY.

The Erysiphei or "Blights."—Those who are accustomed to go about with their eyes open, and are observant of the commoner things in nature—and we by no means wish to include in this class the recent purchasers of 'alligator wood"—can scarcely fail to observe here and there by the wayside, in June, clumps of grass which have the appearance of being covered with a hoar frost. Let some of these specimens be carried carefully home and examined under a low power of the microscope, and the observer will be amply repaid for his trouble. The apparently chalky dust will reveal itself under the form of a forest of vegetable crystallization; "little bundles of delicate threads, clear and crystalline, composed of numerous roundish or spherical cells attached to each other in a bead-like manner," will be seen seated on a network of slender branching filaments called collectively a *mycelium* (Fig 1). This curious and interesting object is the primary stage of a minute parasitic plant belonging to the large and widely disseminated order of cryptogams, the *Fungi*. A mould which has for many years caused great havoc among the grape vines of Europe is just another such incomplete fungus, called *Oidium tuckeri*. The leaves of nearly every lilac bush will be observed in midsummer to be covered with irregular patches of a whitish substance that might, to the casual observer, suggest a coating of dust derived from the road. If one of the leaves be examined at this stage with a powerful lens this apparent dust will be found to consist of delicate cobweb-like threads, branching and interlacing in every direction. Later in the season another examination will reveal, seated on these filaments, numerous little spherical objects, some exceedingly minute and white, others a trifle larger and yellow, and others again brown. The white and yellow bodies are the young, and the dark brown ones the mature fruit of one of these fungi. These interlacing, delicate filaments (called a *mycelium*), along with their fruit, constitute what is popularly known as a "white mildew," "white mould," or "blight;" and such a one as we have described, in company with a host of similar forms, infesting various plants, go to make up the group known to botanists as the *Erysiphei*.



PLANT BLIGHTS OR MOULDS.

1. Grass mould (*Oidium*). 2. Willow blight, magnified 80 diameters. 3. Hazel blight, 80 diameters. 4. Section of willow blight, highly magnified. 5. Tip of appendage of willow blight, magnified 500 times. 6. Tip of viburnum blight, 500 times. 7. Tip of chestnut blight, 500 times. 8. Tip of honeysuckle blight, 500 times. 9. Tip of guelder rose blight, 500 times. *a*. Sporangia escaping from a ruptured conceptacle. *b*. Sporangium of No. 3, with the two spores, magnified 160 diameters.

These little parasites are of melancholy interest to the horticulturist and gardener, to whom they often prove great pests. For most of them grow on living leaves and fruits, and are very destructive, either by "directly diverting the nutritive juices from their proper office and appropriating them to their own use, or by blocking up the *stomata* of the leaves and impeding the free action of the rays of light and of the surrounding atmosphere."

Professor C. E. Bessey, of the Iowa Agricultural College, has recently sent us a paper, with the title which heads this article, in which he has endeavored to collect the scattered literature of the subject, and to give "an enumeration and description of the species known" to occur in America, "and which have been catalogued; with descriptions of all the species." This paper will undoubtedly prove of great service to those beginning the study of the fungi, and who find it difficult to obtain the necessary publications on the subject. Our own experience, however, is that it is very unsafe to rely on descriptions alone for the identification of these microscopic plants, authentic specimens being necessary for comparison. And this is made the more necessary from the fact that more than one species frequently establishes itself on the same host.

But to return to our subject: If one of the brown spherical bodies be placed in a drop of water, under a thin cover, and examined with a high power of the microscope, there will be seen to escape from it, on rupturing its membranous walls by a slight pressure on the cover (*a*), several pyriform, transparent sacs, in which are inclosed a definite number of spores, which vary in different species. The arrangement of these spore cases (*sporangia*) in the interior of the conceptacles is shown in a vertical section at Fig. 4. The number of spore cases (*b*) contained in each of these brown conceptacles varies, according to the genera and species, from one to twenty, or more. The remarkable feature about these little plants, however—that which is calculated to give them an interest outside of any scientific consideration—is the beauty of their ornamentation, which renders them desirable objects for mounting and preservation in the cabinet of every microscopist. Surrounding each conceptacle may be seen, radiating from every side, numerous (usually colorless) appendages. In the genus *Erysiphe*, from which the group takes its name, these appendages are long and floccose; in another genus they are only six or eight in number, and short and needle-shaped, from a bulbous base (Fig. 3); in another they are hooked or curled at their apices (Figs. 2 and 5); in another, again, they are long and once or twice forked; and finally in one genus, *Microsphæria*, the tips of the appendages assume in their ramifications the most exquisite and varied forms. It is almost impossible to do justice to these elegant objects with the pencil, and their marvelous beauty and symmetry can only be appreciated by viewing them under the microscope. We have endeavored to give an idea of their general form in the annexed figures, 6, 7, 8, and 9. There is a wide field for study and investigation in the life history of these little plants, which might well be undertaken by some of our microscopists who have good instruments and no definite work in hand. The Rev. M. J. Berkeley has already described and figured (*Transactions Horticultural Society*, vol. ix., p. 68) five different forms of fruit which are produced during the course of the development of the hop-blight: First, the moniliform threads on the mycelium, which we have already alluded to as *Oidium* (Fig. 1); second, large stylospores produced in sporangia; third, smaller stylospores generated in pycnidia; fourth, sporules formed in the joints of the necklace-like *Oidium* stage; and fifth, the sporangia containing the spores produced in conceptacles, such as we have described, and which is the mature fruit of the fungus.

The Olive as an American Product.

The olive has been successfully grown in California and in South Carolina, though not for profit. Gen. A. C. Jones, of the Department of Agriculture, after a careful investigation of the matter, is confident that there is no good reason why olive culture should not be profitably added to the list of our industries. The forthcoming annual report of the Department contains a paper in which is given a large amount of information with regard to the soils and climates most favorable to these trees, and the inducements they offer to the cultivator. In full bearing the olive tree yields from two to three bushels of fruit, producing from fifteen to twenty pounds of oil. An acre of land properly planted should contain about one hundred trees, and grass or other crops may be cultivated between the trees to advantage. Throughout the Mediterranean region the olive is an important source of industrial wealth; and since, in many parts, the climate of our country is not unfriendly to the tree, its cultivation may prove a real and valuable addition to our resources.

Our Exports.

The value of fifteen of our principal articles of export for the year 1877 was as follows: Cotton, $171,118,508; petroleum, $61,789,438; bacon and ham, $49,512,621; wheat, $47,135,562; Indian corn, $41,621,245; tobacco, $32,020,214; lard, $25,562,665; gold and silver, coin and bullion, $42,966,035; wheat flour, $21,603,947; lumber, $15,041,747; cheese, $12,700,627; wool and woolen goods, $9,834,849; tallow, $7,883,616; beef, $7,503,475. It is a notable fact that petroleum, the product of a small area in an otherwise worthless region, stands second on the list. It brings to this country from abroad more gold than any other commodity except cotton. Fifteen years ago not a barrel had been exported. For ages petroleum had been known in the Old World, yet its use was comparatively insignificant until American inventors devised the means for collecting it in unlimited quantities, and a thousand other means for transporting, refining, and applying it to profitable uses. Who can tell what other natural products of incalculable value are still lying undeveloped, waiting for the genius of our inventors to call them into life and usefulness?

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New Agricultural Inventions.

Mr. G. R. Pierpont, of North Haven, Conn., has invented a new Straw Cutter, or machine for cutting hay, straw, etc., for feed. It has two cutting blades, pivoted together like a pair of scissors, operated by connecting bars and a double crank, and arranged at the end of the feed box, in connection with an adjustable gauge plate and guides.

An improved Machine for Separating Garlic from Grain, recently patented by Messrs. D. Shamberger and J. Carroll, of Beckleysville, Md., consists of a revolving cylinder having teeth or cards, in combination with a pressure roller at one side and a clearing brush at the opposite side, the grain being conducted off below the pressure roller and the garlic below the clearing brush.

Mr. N. D. Edmondson, of Crown Point, Ind., has designed an improved Sulky Scraper for grading roads, lawns, etc., in which the mechanism for holding the scraper in position for collecting or discharging the load, or carrying it from place to place, is efficient and readily controlled by the driver.

A light and strong Picket Fence, patented by Mr. C. H. Phelps, of Williamsfield, Ohio, is made by combining, with the pickets, longitudinal T rails formed of two side bars riveted to the pickets, and slotted top bars secured to the side bars by keys through the pickets. The posts are braced by anchors secured to the fence by brace rods and a yoke.

A new Gate, of the class in which a person on horseback or in a wagon is enabled to open or close the gate by operating a projecting lever, has been patented by Mr. B. B. Huntington, of New Richmond, Wis. Its advantage consists in simplicity of construction and being made without pulleys or wires.

A convenient Apparatus for Steaming Feed, which is claimed to generate steam with small consumption of fuel, and to furnish dry steam for heating, etc., has been patented by Messrs. D. D. Darling, L. L. Parshall, and F. H. Wendell, of Coldwater, Mich. It consists of a furnace with a central tube and coil of pipe, connected by a top and bottom pipe, with a tank having a central downward extending pipe for supplying water, a float, and a steam exit pipe.

Mr. S. Carnes, of Jonesborough, Ga., has made an improvement in Plow Stocks, intended to give increased strength and lightness. It consists in making the standard in two parts, bolted together at their middle and lower ends, one bar passing up and bending over the plow beam and adjustable vertically upon it, while the other bar is bent rearwardly to form a brace.

Mr. H. M. Freeman, of Lathrop, Mo., is the inventor of an improved Riding Attachment for Plows, which is claimed to be so constructed that the plow may be adjusted to work at any desired depth, that the frame is kept level whether the plow is running upon a level with the wheel or below it, and that the plow may be turned upon a square corner.

An improved Bale Tie, invented by Mr. C. H. Chase, of New Orleans, La., is a strip of sheet metal having one of its ends doubled over upon itself, the same being bent on a line drawn across the strip at an angle of 45°, so that the folded end forms a right angle with the main part of the strip. The folded over portion is returned upon itself and again bent forward, forming a U-shaped loop for receiving the opposite end of the tie, which has oblong apertures for receiving the bent end.

Mr. S. Ruggles, of Three Rivers, Mass., has patented a Potato Bug Exterminator, consisting of a poison reservoir carried on the back, and having two sprinkling tubes, so as to save time by operating on two rows of plants at once. Within the reservoir is a reciprocating stirrer, which is operated by an angular lever strapped to the arm.

An improvement upon the Corn Sheller patented August 17, 1875, by Messrs. W. H. Hall and C. S. Yingst, of Tiffin, Ohio, has been made by one of the original patentees, Mr. Hall. It relates to details of construction designed to produce a better article at less cost than heretofore practicable.

Mr. Henry Cutler, of Wilbraham, Mass., is the inventor of a new Grain Drier which is claimed to effect its purpose rapidly without danger of burning the grain. It consists of a cylinder, provided with suitable feed and discharge ducts, and heated by a current of hot air. In this is a revolving hollow shaft carrying steam heated arms, which constantly stir the grain.

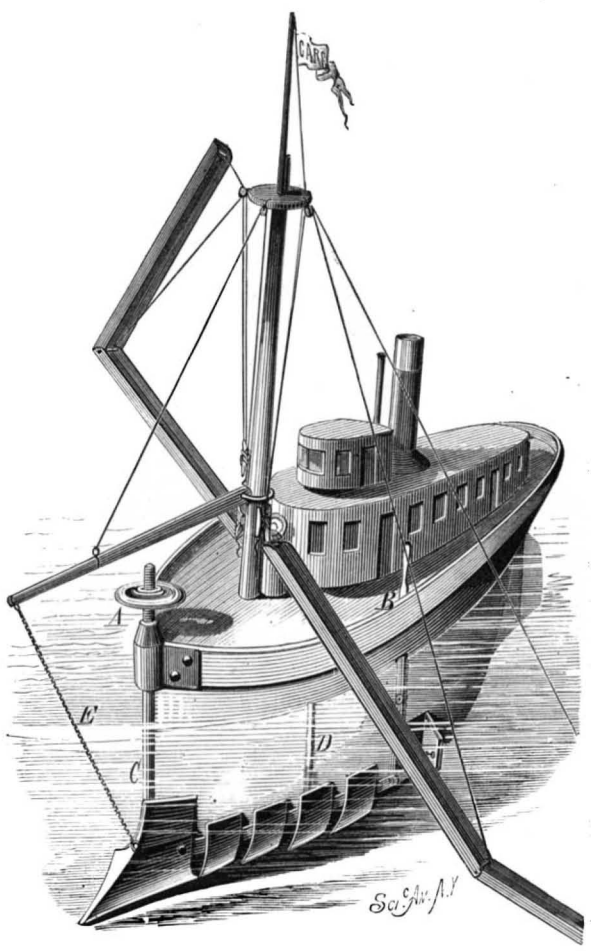
Mr. R. W. Hazen, of Fremont, Neb., has patented an improved Ventilator for Corn Cribs, for ventilating the mass of the corn, to prevent it from spoiling, hasten the drying, and bring it quicker into marketable condition. The invention consists in slotting the floor of the crib with air passages, and by a peculiar arrangement of boards and blocks preventing leakage of any shelled corn.

An improved Hay Press, invented by Mr. H. R. Smith, of Minnesota Lake, Minn., may be briefly described as a pressbox with a reciprocating follower, operated by suitable lever mechanism. The top and bottom of the pressbox are longitudinally slotted, the slots being wider at one end than the other, for the purpose of facilitating the passage of the bands in tying them around the bale. The follower is made of sections with enlarged heads, which leave spaces just wide enough for the passage of the bands.

A new Baling Press has been invented by Mr. J. H. Simonson, of East Norwich, N. Y. The peculiarity of construction is the means by which the power and resistance are both applied to compressing the bale, and the automatic upward movement of the upper follower when the power is removed.

CARR'S IMPROVED DREDGER.

We illustrate herewith a new submarine excavator, designed to be attached directly to the bow and sides of a vessel, and to be used for removing sand bars, submarine marshes, and other obstructions to navigation.



CARR'S IMPROVED DREDGER.

On the bow of the boat is an iron bar, to the lower end of which is secured a double mould-board plow. The upper end of the bar forms a screw rod, passes through a bearing, and is provided with a wheel, A. To each wing of the plow is pivoted a bar, and to these bars are attached several single mould-board plows. To the rear end of each bar is attached a jointed lever, B, by means of which each series of plows can be raised or lowered, while all the plows can be lifted by the wheel, A. This adjustment being at the bow of the boat, if the vessel is stopped before it gets through an obstruction, the plows can be raised, and the boat backed and extricated. The plows may then be lowered again and work resumed. As the plows enter the bottom the material is loosened and swept away by the current. The front plow is firmly secured by a shield, C, and side bars, D, are provided to keep the side plows from swinging under the boat. In case there is not enough current to remove the loosened matter, the inventor proposes to use a centrifugal pump, placed in the center of the boat, whereby the water can be raised and discharged into tank flats; or, by means of troughs on each side of the boat, can be discharged from thirty to forty feet from each side of the same, thus making a channel from sixty to eighty feet wide. When it is desired to lower the plows several feet below the boat, the chain, E, from the bowsprit relieves the increased strain on the upright plow beam.

Patented April 9, 1878. For further particulars address the inventor, Dr. Thomas B. Carr, Wilmington, N. C.

The Newton Photo-Plates.

At a recent meeting of the Photographic Section of the American Institute, in this city, examples of pictures taken by means of the emulsion or sensitized collodion of Mr. Henry J. Newton were exhibited. The author claimed that his emulsion plates were as sensitive to weak lights as any bath plates that can possibly be made; that they give all the detail in the shadows or dark places that it is possible to get by any process; that the emulsion keeps indefinitely; finally, that the Newton emulsion will do anything that can be done with the bath plate in one third of the time.

Mr. Bierstadt accepted the challenge of Mr. Newton as to bath plates, but at the same time stated that the Newton negatives there exhibited, done in eight seconds, and the prints therefrom, he had never seen excelled, if equaled, by any photographic process.

Mr. Mason, another distinguished photographer, pronounced the specimens perfect, the details in the shadows and high lights as finely rendered as any that he had ever seen.

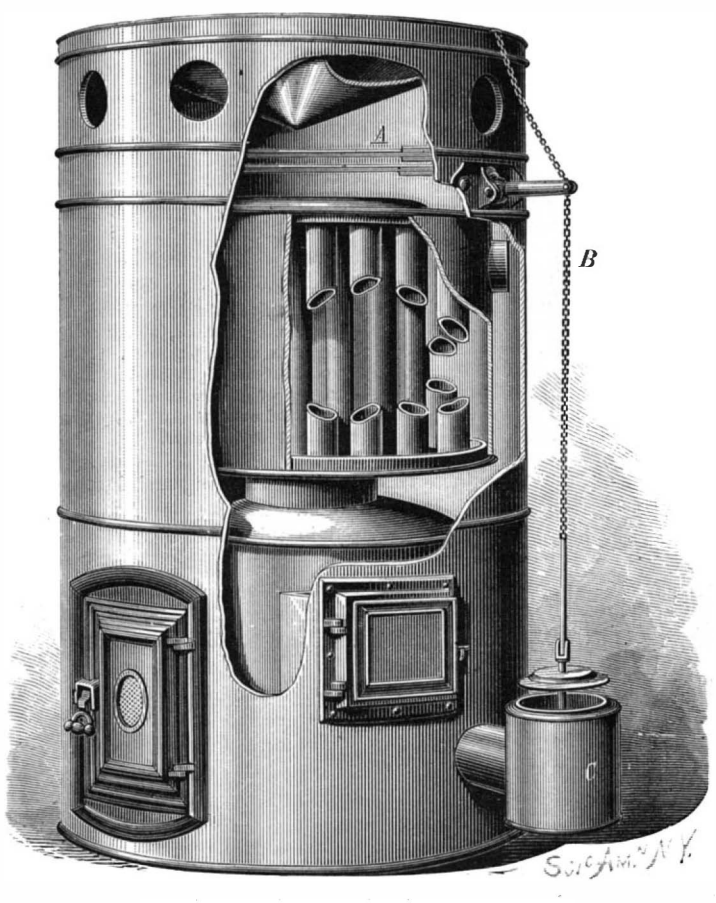
A description of the Newton process was given several months ago in the SCIENTIFIC AMERICAN.

Adulteration of Soap.

The following receipt is extracted by *Dingler's Pol. Journal* from the *New Soap Boiler's Journal* (*Neue Seifensiederzeitung*): "Saponify 600 kilos. cotton seed oil, 200 kilos. tallow, and 200 kilos. bone oil, with potash lye at 18° in the usual manner. A thick mixture is then made of solution of potash, potato flour, and soluble silicate of soda, and two parts of soap are crutched thoroughly up with one part of this mixture, boiled, and mixed with more soda lye till the total weight rises to more than double that of the fatty matter originally present." *Dingler's Journal* remarks that when trade organs thus openly recommend sophistication caution is needful on the part of purchasers.

IMPROVED HOT AIR FURNACE.

We illustrate in the accompanying engraving an improved hot air furnace, the principal novelty in which is the automatic means for regulating the admission of cold air into the fire chamber. This device consists in a series of brass strips at A, connected together and aggregating a length of some fifteen feet. These are so arranged that the total movement due to their expansion is communicated to the chain, B, which passes around an arm and operates a double valve at C, in the air passage leading to the fire box. The contraction of the strips raises the valves and admits air to the furnace; their expansion due to an increase of temperature allows the valves to drop on the seats and so exclude air. It will be observed that the air is admitted at the side of the fuel, and that there is no damper in the smoke pipe. Smoke is thus caused to be consumed, and the fire is much more easily regulated.



HOLCOMB'S HOT AIR FURNACE.

The fire box is made of No. 16 wrought sheet iron, and is lined with specially prepared fire brick. The radiator contains 24 tubes, each 3½ inches in diameter, made of soft charcoal wrought sheet iron. The general shape of the furnace is such that the heat is diffused evenly over the inside. The conical cap on top deflects the heated air into the hot air pipes. It can easily be removed to afford access to the interior.

Patented April 16, 1878. For further particulars address the inventor, Mr. Henry Holcomb, Painesville, Lake Co., Ohio.

Live Hogs for England.

A number of butchers and provision dealers in Liverpool, England, have clubbed together for an experimental importation of live hogs from this country. They have purchased a steamer and had her fitted for the accommodation of 2,500 hogs between decks, besides a large number of cattle on the main deck. If the venture turns out well they propose to establish a full line of steamers for this business. Facilities have been provided for killing and dressing the hogs on board in case of necessity.

Six Years' Progress in Making Steel Rails.

The manufacture of steel rails was begun in this country in 1872. During that year 94,000 tons were made; in 1873, 129,000 tons; in 1874, 145,000 tons; in 1875, 300,000 tons; in 1876, 400,000 tons; in 1877, 420,000 tons. During the present year the product is expected to reach as many as 500,000 tons. In 1872 the average price of a ton of Bessemer steel rails was $115. Now the average value is about $42. Owing

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to recent improvements in machinery it is expected that the cost of production will be reduced to such an extent as to enable America to compete successfully with England in neutral markets. Inquiries begin to come in from South America, and there is a fair prospect that in a few years the exportation of steel rails will become possible.

BIRDS OF PARADISE.

The Zoölogical Society, of London, have just made an important addition to their attractive collection in the shape of two male examples of the lesser Bird of Paradise in full plumage, for an illustration of which we are indebted to the *Illustrated London News.*

The lesser Bird of Paradise (so called from its being somewhat smaller in size, though not inferior in beauty to the greater Bird of Paradise, *Paradisea apoda* of naturalists) is very abundant in certain parts of the northern peninsula of New Guinea, and is also found in the adjacent islands of Mysol and Salawatty. It lives in bands in the vast forests, feeding principally on mucilaginous fruits of various fig trees, but occasionally devouring grasshoppers, locusts, and other insects. The splendid plumes, so well known under the name of Paradise Birds' feathers, are only developed by the adult male birds, the females and young males being comparatively insignificant in appearance. These specimens are very rare, only two examples of the same species having been previously conveyed to England.

BIRDS OF PARADISE.

Silk Culture in America.

In January, 1876, Mr. Samuel Lowery, principal of an industrial school for colored people, at Huntsville, Ala., started the culture of silkworms in that State by procuring 500 eggs. Only 200 proved fruitful; but from the cocoons spun by them about fifteen spools of silk thread were made by a rude hand process. The thread was exhibited at the Huntsville Fair, and attracted considerable attention. In 1876, Mr. Lowery hatched 500 worms, from which he got silk enough for twenty spools of thread. Last year the crop numbered 100,000 worms. Fed on white mulberry trees, the worms did well, and thus far no symptoms of disease have been noticed. It is now proposed to plant twenty acres with mulberry cuttings, which, in the course of a year, will furnish food for two or three million worms.

The new industry is thought to be very promising for the colored population of the South. Suitable land can be had for from $4 to $20 an acre, and farms of twenty acres or less will furnish employment and support for a family. In France the silk culture is almost wholly carried on by small farmers, and in Alabama the cultivators have the advantage of being able to gather two harvests in a year. Raw silk is worth from $4 to $6 a pound, and the value of raw silk imported amounts to something like $6,000,000 a year.

FIBRIN.—M. Setchenoff has found that the white of eggs, on being boiled in vacuum, turns solid as fibrin. In order to ascertain if the yellow of eggs has some influence on this reaction, experiments were made, and it was found that when a small quantity of the yellow is admixed, the solidification of the albumen, as mentioned above, is five times quicker. This fact, besides being a matter of great importance for physiology, allows us to obtain the albumen in a more pure form.

Test of Woody Fiber.

Dr. Wiesner recommends phloroglucin as an extraordinarily delicate reagent for woody fiber. Place a drop of a half per cent solution of phloroglucin upon a bit of pine, and moisten the spot with a drop of hydrochloric acid, and there immediately appears a beautiful lively red stain, verging upon violet. On drying, the violet tinge becomes still more marked. Even if the solution contains only one hundredth of one per cent of phloroglucin, the red color is very decided; and if there is not more than one thousandth of one per cent, the reaction can be recognized, under proper precautions. If a strip of pine is allowed to remain in such a solution for twenty-four hours, hydrochloric acid gradually draws out a perceptibly reddish satin. The slightest traces of woody substance in vegetable tissues can be readily detected in this manner. The tenderest germs, by means of this reaction, show a woodiness in the cells. Every trace of woody substance in hemp and flax can be detected by the phloroglucin. Dr. Wiesner suggests that it may be used to distinguish hemp from flax, and also as a means of dyeing fabrics woven from vegetable fibers.—*Dingler's Polytech. Jour.*

The Sugar we Use.

The United States consumes annually between six and seven hundred thousand long tons of cane sugar, less than 13 per cent of which is of home production. The leading sources of foreign supply are; Cuba, 450,000 tons; Spanish possessions, 50,000; Porto Rico, 30,000; French islands, 22,000; Brazil, 18,000; Dutch East Indies, 11,000; British West Indies, 10,000; British Guiana, 10,000; Sandwich Islands, 10,000. Twenty-one other countries supply less than as many thousand tons in all. In 1862 our home product was 191,000 tons; it fell to 5,000 tons in 1865; then slowly rose to 79,600 tons in 1871. The crop of 1876 was 77,000 tons.

American Leather in Europe.

We have the testimony of the leading manufacturer of boots and shoes in Europe to the effect that the leather market is no longer in European hands. America regulates the price, and from being a large importer, we have turned the current, and are exporting enough to affect European production seriously. In his pamphlet, "Look out for Yourselves," addressed to Swiss manufacturers, Mr. Bally says: "European seaports have become, in part, great depots of American leather. All the Europeans interested in the manufacture of leather speak badly of this red American leather; but it is not so much because of its quality and the short time employed in tanning it (because in these respects it can bear comparison with European leather) as because of the very successful competition of this article. Certainly it is not very pleasant to be compelled to recognize the fact that a former market has become a dangerous competitor." Efforts were made as early as 1847 to find a market in England for American leather, and again twenty years later; but it was not until 1872 that an actual demand began to be felt. In the latter half of that year the export of sole leather, from the port of New York, was 311,914 sides; the next year about 660,000 sides were exported; in 1874, nearly 860,000; in 1875, over 917,000; in 1876, there were exported 1,084,522 sides; and from January to November, 1877, the number reached 863,434 sides. A little more than half the leather exported passes through New York. Last year the tanned leather shipped from Boston exceeded $2,000,000 in value. The exports from Philadelphia, for the same period, amounted to nearly $1,000,000.

Nearly half the leather exported goes to Germany. The English now rate American leather as unexcelled by any except their best oak-tanned. The German dealers will take nothing but the very best leather.

There is little difference in the machinery employed in the tanneries of this country and England; but owing to the high price of bark the English have resorted to chemical substitutes, and the quality of their leather has been injured. The same cause tends to decrease the annual product of Germany. France keeps out American leather by a high tariff. Denmark, Norway, and Sweden are importing it in small quantities, and there is a small but growing trade with Russia. In addition to a considerable quantity of rough and finished upper leather, the export this year from all American ports is estimated to be likely to reach 2,000,000 sides. American leather of all kinds, with the exception of finished calf finds a ready market abroad.

The Bahama Pineapple Tree.

A large proportion of the area of the Bahama Islands is devoted to the cultivation of fruit, of which oranges and pineapples are the principal; and at the present time the fields in the estates on which the pineapples are growing form a peculiar feature in the landscape. The appearance of the broad expanse of young fruit, with its clusters of delicately tinted, but sharp and serrated leaves, rising only a short distance from the ground, and covering the undulating fields, produces a very remarkable effect. In no other branch of agriculture can so curious a picture be produced as in the growth of these vast numbers of pines. As many as a million and a half of the fruit have been collected from a single

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acre at one crop. The appearance of these pineapple estates has as little in common with the sugar plantations or paddy-fields of the tropics as with the corn fields or vineries of Europe. In a few weeks these pineapples will be making their appearance in the English markets. They are shipped in an unripe state, and mature during the voyage, and hence are not so excellent in quality as the English hot-house fruit, or as if they were properly ripened in the ground. The pineapples of New Providence, however, are superior to any other variety, and often attain an enormous size. One, grown in Pembrokeshire, weighing 10½ lbs., and measuring 10½ in. in height, exclusive of stalk and crown, and 22 in. in circumference, was served up at the coronation banquet of George IV., and since then the improved modes of cultivation have greatly increased the size and quality of the fruit. There is an enormous demand for the Bahama pineapples both in Europe and America, and a new industry has lately sprung up in the island in preserving the fruit in tins when they are fully ripened; one factory in Nassau alone exports annually a million tins, valued at £16,000. These fruits are superior to those sent away earlier in the season, as they are ripened naturally and packed in perfect condition, instead of being gathered when only half ripe.—*The Colonies and India.*

New Mechanical Inventions.

An improvement in Dies for Forming Settings for rings, lockets, etc., is the subject of a patent recently issued to Mr. H. Henrich, of New York city. In the face of the lower die is a cavity of the proper size having beveled edges. A block is inserted, leaving a wedge-shaped groove between it and the bevel of the die. The blank is then forced into this groove by the impact of the top die or stamp, and a setting, having an outer beveled edge and interior square shoulder, is thus formed at one operation.

The Power Hammers commonly used in the manufacture of charcoal blooms, billets, and other iron are made in one casting, and the continual jarring often impairs the quality of the cast iron of which they are made, so that the arms break, and a new casting is required. Mr. G. M. Dillon, of Chateaugay Lake, N. Y., seeks to obviate this difficulty by making the hammer in two parts, namely, the arms which carry the breaking, drawing, and smoothing faces, and the husk or rocker into which the arms are fitted, the arms being secured by wooden wedges.

Mr. P. A. Peer, of Comstock, Mich., has made an improvement in Fan Mill Irons, which consists in using a hub or spider cast with radial loop sockets, to receive the arms of the fans, and keyed upon the driving shaft. Each arm rests against a shoulder on the hub, and is secured by a nail or screw on the inside of the socket.

In a new Washing Machine, patented by Mr. Wm. Haas, of Walla Walla, W. T., the principal features are lower stationary and upper reciprocating beaters, the latter pivoted in a way to secure a peculiar sliding motion; the division of the suds box by a slotted partition, on one side of which are the beaters and clothes, and on the other the arm and pivot of the movable beater; and the peculiar jointing of the connecting bar which operates the movable beater, allowing the latter to be raised so as to permit the clothes to be readily inserted or removed.

An ingenious Odometer, or instrument for measuring and indicating the distance traveled by a carriage, has been patented by Mr. L. C. Perkins, of Webster, Mass. It is intended for the use of liveries, where it is desirable to know the exact amount of work performed by the horses during absence from the stable, and its mechanism is prevented from being tampered with by means of a sealed cover.

Mr. Albert Demo, of Camden, N. J., has invented a novel Marine Engine, suited to a peculiar class of steamer. It is constructed so as to drive the paddles against the water with greater force than that with which they are drawn back, keeps the paddles at right angles to the line of stroke during the propelling movement, and closes them to a feather while being drawn back. Special arrangement is made to prevent jar at the ends of the stroke.

Olive Oil Soap.

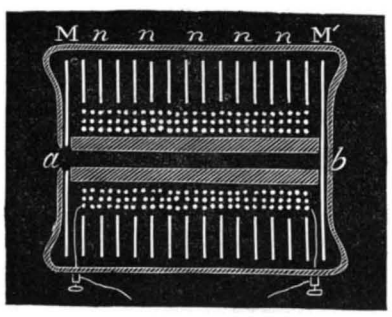
The article soap appears destined to become one of the principal industrial products of the island of Corfu. The chief obstacles in the way of increased production—namely, the scarcity or dearness of the two main substances which enter into its composition—are in a fair way of being removed. The first and most costly of these ingredients, olive oil, is being produced in increasing quantities. The method employed for crushing the olives preparatory to extracting the oil is of the most primitive kind: a vertical stone cylinder of great volume and weight, attached to a shaft, is made to revolve by horse power in a slightly concave bed of the most solid construction. In this receptacle the freshly gathered olives are placed, and by the action of the revolving cylinder reduced to a pulp more or less comminuted according to the degree of pressure. The pulp is then removed and inclosed in flat circular bags of about two feet in diameter, and then subjected to the action of a strong screw press, set in motion by a lever projecting horizontally, and worked by the united efforts of several men. When under this operation, which is most laborious, the oil ceases to flow, the now strongly impressed pulp is withdrawn, and collected in heaps out of doors, where it is left to dry or ferment according to the accidents of the weather. Till recent times this refuse was occasionally employed as a manure, and partly used by the bakers for heating their ovens. For this latter purpose it was largely exported to Malta, where it fetched remunerative prices; and this traffic continued until it was put a stop to by the imposition of an export duty by the Hellenic Government, which absorbed the whole of the profits previously obtained.

The accumulation of this material in the islands, in all of which olive oil forms one of the chief products, says the *Journal of the Society of Arts*, had become enormous, in spite of the local consumption for the purposes above stated, when it occurred to some ingenious person to subject it to a chemical analysis, with the view to turning its properties to some useful account. The result was that it was found to contain from 2 to 4 per cent of pure oil. This discovery once made, in 1869 a firm, composed of three enterprising capitalists, was established, and works on a large scale were constructed, with a view to extracting the oil. The process employed is both simple and ingenious, and has turned out a complete success. It consists in forcing, at a high temperature, bisulphide of carbon through a given quantity of the refuse, which, after being reduced to a fine powder by being passed between cast iron rollers, is inclosed in an air-tight metal cylinder of great strength, communicating with another receptacle or reservoir, also air-tight, through which the bisulphide is forced from beneath, carrying along with it the oil disengaged by its action. After a sufficient time allowed for cooling, the reservoir is opened, when the oil, now of a greenish color, but almost inodorous, is found floating on the surface of the bisulphide, whence it is bailed out and preserved in casks. The bisulphide remains unchanged in its qualities, and but slightly diminished in quantity, ready, with slender additions, for operating afresh. This substance is now known in commerce under the designation of "pyreune oil," from the Greek word signifying core, or kernel.

The second ingredient is soda, which has to be wholly imported from abroad, at a proportionately high cost. An almost unlimited supply might be obtained were the manufacture of sea salt, from which it is extracted, carried on to an extent of which it is capable. It is satisfactory to observe that a concession of the extensive salines at the western extremity of the capacious bay, which extends beyond the town and port of Corfu, has been obtained from the government on advantageous terms, by a private company, with the view of employing the produce in the manufacture of soda, for which works are in the process of erection. The soap, which is made by hand, is, for the most part, exported to Continental Greece and Turkey; as, also, a portion of it to Triest and Venice. It is packed in deal boxes, containing 150 lbs. each. As the profits to be derived from introducing this article into the English market have not escaped the calculations of the manufacturers, it is but fair to state that the purer ingredients in its composition are occasionally adulterated by an admixture of fuller's earth, which, while it adds considerably to the weight, impairs its quality.

M. TROUVE'S NEW TELEPHONE IMPROVEMENTS.

M. Trouvé has recently communicated to the French Academy of Sciences an account of a new telephone which he has devised, which, while being a modification of Bell's, gives, it is stated, much better results. Its construction will be understood from the engraving herewith given. *a b* is a tubular magnet surrounded by a coil of wire. Opposite one pole, *a*, is a circular membrane, M, similar to that on the ordinary telephone, except that it is pierced with a central hole, the diameter of which equals that of the aperture through the magnet. Opposite the other pole, *b*, is a diaphragm, M′, in which there is no orifice. If speech be uttered before the diaphragm, M, the sonorous waves throw it into vibration, and then, continuing, their movement through the magnet excites the diaphragm, M′. The magnet is thus influenced at both poles, and much more intense currents are induced in the coil. The receiving apparatus, similar to that just described, receives the corresponding currents, and its two diaphragms likewise vibrate. The ear, placed at *a*, receives the sounds, therefore, from both.



In order to compare, experimentally, the results furnished by the Bell telephone with those of the multiple telephone, sounds were received on the unperforated diaphragm of the latter alone, which, thus used, corresponds to the ordinary Bell instrument. Then the multiple telephone was turned, and on placing the ear at the opening, *a*, it was at once remarked that the intensity of the sound was doubled. The sound is still further augmented by placing between the end diaphragms a series of others, *n*, rounding the solenoid and influencing it over its entire length.

M. Trouvé has, besides, recently invented a telephone on a new principle, which is made as follows: A metallic vibrating membrane constitutes one of the poles of a high tension battery. The other pole is adjusted before the plate by a micrometer screw, which allows of varying its distance from the membrane without the two ever coming in contact. This distance, however, should never exceed that which the battery current can pass over. If by sonorous waves the transmitting membrane is caused to vibrate, during the vibrating movement the distance between the poles, and hence the intensity of the current, will be constantly modified. These modifications determine, in the receiving apparatus, variations of magnetism corresponding to variations of intensity of the transmitting current, which cause the vibration of the receiving membrane. It will be observed that this new telephonic system is based on the resistance of the exterior current of a high tension battery, and this it would seem possible to modify within very wide limits by placing the membrane in different media, such as rarefied air or other gases, to which vapors capable of modifying the resistance might be added.

Is there a Hole through Mercury?—Are all the Planets Rings?

Mr. Richard A. Proctor, the eminent astronomer and eloquent lecturer, gives a report in one of the English papers of his personal observations of the recent transit of Mercury, made with an 8½ inch reflector, and notes a very interesting if not remarkable discovery. He says:

"A bright spot was seen on Mercury's disk. It appeared to me perfectly central and of sensible magnitude. My eldest daughter, who observed with me, described it as a mere point, and quite central, as if the disk were a round piece of black card, and the bright spot were a hole pierced through with the compass point in striking out its circular outline, I noticed one feature in the bright spot which seemed to me decisive as to its subjective nature: when a small cloud passed over part of the sun's face, nearly the whole of which was in the field of view, the bright spot perceptibly waned in brightness, though not crossed by the cloud. This I noticed distinctly three several times. Another feature—perhaps a mere illusion—was that it seemed to me, as the spot thus waxed and waned in brightness, that it was triangular in shape. I could not distinctly recognize this peculiarity when the luster of the spot was steady. The aspect of the spot was not perceptibly modified when the telescope was released from the driving clock and Mercury allowed to approach the edge of the rather wide field of view."

We published in the Scientific American several years ago the vagaries of a backwoods philosopher to the effect that our earth had a central cavity of enormous dimensions, extending from pole to pole, through which the ocean waters ebbed and flowed; and he declared that whenever any ship could reach the north pole it might sail placidly into the aforesaid cavity and reach the bowels of the earth; where a strange race of human beings would be found living in peace and happiness; with other marvels in multitudinous numbers.

In view of Mr. Proctor's discovery, the knowledge that Saturn has planetary rings, the fact that when a milk pail is whirled like Jupiter the liquid moves outward, leaving an opening in the center, who knows but Mercury has a hole through it, and that the bright spot seen by Mr. Proctor was simply the sun shining through the aperture? If Mercury is tubular, may not the earth be also? This is one of the questions that Captain Howgate or Mr. Bennett have before them for solution in carrying forward their polar expeditions.

The Use of the Agricultural Department.

The annual attack upon the Department of Agriculture is serviceable in bringing into strong relief the advantages derived from its labors. Some points brought out in the recent discussions in Congress are worth noting. In justification of the work of distributing seeds, a member said that the seed oats sent out to the Northwest have improved that crop more than enough to pay all the expenses of the Department for the past five years. Another member said that a single package of Foltz wheat received in Kansas a few years ago had been the means of changing the entire product of a large area, giving the best article they had ever had. Similarly of sorghum, which has put millions into the pockets of the farmers of the West, said a member, "The molasses and sugar that have been produced from it will more than pay every dollar expended upon the Agricultural Department."

Our Steam Street Railways.

The New York correspondent of the Baltimore *Sun* is evidently not in love with the new system of iron railway bridges that now occupy some of our finest avenues. Speaking of the Gilbert Elevated Railway and the recent accident caused by one of the first trains, he says:

"Celebrating the event by frightening a car team on a track below into a mad runaway, the Gilbert elevated vehicles may now be considered as available for all travelers wishing to avoid death in curb shattered or post splintered conveyances of the streets. The moving, hideously clattering crest of a straddling iron monster, which has settled upon miles of once thriving thoroughfares, to suck all the business life out of them, the Gilbert cars are the sworn enemies of equine and human nerves alike, and will have what sonorous reporters call their 'holocaust' of victims before the year is out."

American Stamping Mill for Peru.

An eighty stamp mill, one of the most complete and powerful ever undertaken, is in process of construction in this city, for use at the famous Oroya silver mines of Peru. It is to be ready for shipment July 1, and will require a 1,200 ton ship for its transportation.

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PLANT MIND.

VII.

THE NERVES OF PLANTS.

The distinction or "boundary line" between plants and animals or between animal and plant life is not to be found; we are inclined to believe, does not exist. The arcana of life operation and life source have been explored in all their recesses, only with this measure of successful result, to prove that "all the boundless universe is life." In organization and function, in construction and requirements, plant life is not inferior to animal life; in delicacy, sensitiveness, and beauty only a part of the sublime unity and variety which express a Creator and a God throughout the visible works of His almighty hand. Variety of expression, in conjunction with fundamental principles of organic and mental life, seems to be the point at the base to which we are led, and from which we begin again when we attempt to read the "open secrets" of creative revelation which await our intelligent and loving recognizance.

Plant organization, reduced to its simplest form, is exhibited in the action of those threads, or internal *capillitium*, which, being spiral in their arrangement, conform to the fundamental law of harmony between structure and requirement, or fitness of contrivance, and by intuitive analogy, when microscopic investigation reveals the existence of channels for the conveyance of an ethereal fluid, expended in the acts of contraction and extension, in movements of approximation and fructification, in the care of offspring, evident sense of well-being or dejection; determined pursuit of light, air, and nutriment; submission and resistance—all these and more stimulate conjecture, and modern thinkers approach certainty, thus revolutionizing popular thought and every-day vision, until he "who had only eyes, now learns to see."

The presence of nerves in vegetable beings is from its very nature an obscure question, relating, as it does, pre-eminently to their internal structure, and some modern thinkers have even argued that their absence need not prove inanimation. This argument is advanced by M. Fechner, an eminent German naturalist. On the other hand, the Swedish botanist, Oken, saw nerves in the spiral fibers, and claimed the distinction of being the first botanist who admitted their purpose and office. Goethe held the same view; while our own American professor, Harlan Coultas, expands the idea of a ruling mind, operating upon and directing those subtle fluids and channels of communication, teaching most lucidly the roots, stems, leaves, buds, are parts of one individual, and each contains a link of connection with all its parts, as do muscles, bones, nerves, tissues, in the human frame. Indeed the nerves reach to the extremities of the whole vegetable body, and are the channels of communication with the sensorium, brain, or controlling force. The principle of unity is found to be complete, and, once fully recognized, we are easily led to believe it possible that even plant life may be capable of thought, adapted to the necessities and felicities of its plant individuality.

The first regular form seen by the unassisted vision, in the inner surface of the cell, is the spiral, and all subsequent additions assume this form, and can be resolved into it as their normal type. The *Trygnemas*, to be found in the pools and streams of India, and as high as 15,000 feet among the Himalayas, in the ice cold springs trickling from the edges of glaciers, are among the largest among the *Confervæ*, and have filaments as rigid and thick as horsehair. Under the microscope these filaments are seen to be joined by transverse tubes parallel to each other, and marked by articulations longer than broad. In their internal granular matter they exhibit the spiral arrangement, in some cases resembling repetitions of the Roman numeral X, and in others a series of the letter V; the spiral rings after conjugating producing a dark colored globule in one of the filaments.

Voluntary motion in one of its simplest forms is also exhibited in the class of *Confervæ* called Oscillatoriæ, which grow in masses of filaments based on a mucilaginous substance. Their filaments are elastic, simple, minute, and mathematically straight; distinguished by close parallel rings easily separating from each other. They oscillate to the right and left, and travel in a few hours to the distance of ten times their own length from the stratum. Many species have at their extremities a tuft of minute delicate *ciliæ* or hairs, which are constantly in motion. Three or four days constitute the average of their cycle of life. Dead filaments form the bases of living ones, and this peculiarity connects them with the coral zoöphytes, although there seems to be no necessity for supplying links between vegetable and animal life, but rather to recognize the simple universality of boundless life itself.

The functions of fructification and reproduction especially require a nervous apparatus of extreme delicacy and sensitive obedience to the controlling force of animation, and we find organisms in the hitherto much unexplored kingdoms of lichens, which bring abundant evidence in support of this statement. The cylindrical filaments which surround the cellules, and, we believe, invariably connected with them, form a beautiful network of meshes, and may be seen beautifully illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 126. In the approximation of filaments the sensations of need and supply are expressed and satisfied. Corresponding processes are thrown out, forming a transverse tube of communication, through which the endochrome of one can pass into the other, forming the round mass which becomes seeds or spores for reproduction of new beings.

The River Semania (*Semania fluviatilis*) has elastic, rigid, and bristly filaments, knotted at equal distances with swelling joints, springing from a cartilaginous disk, by which it is firmly held against the force and weight of strong currents and Alpine cascades. The sporules within the fronds break with great force through the tough knots at the joints, and Borg relates that these filaments have a movement of retraction which can be felt by the fingers which hold them.

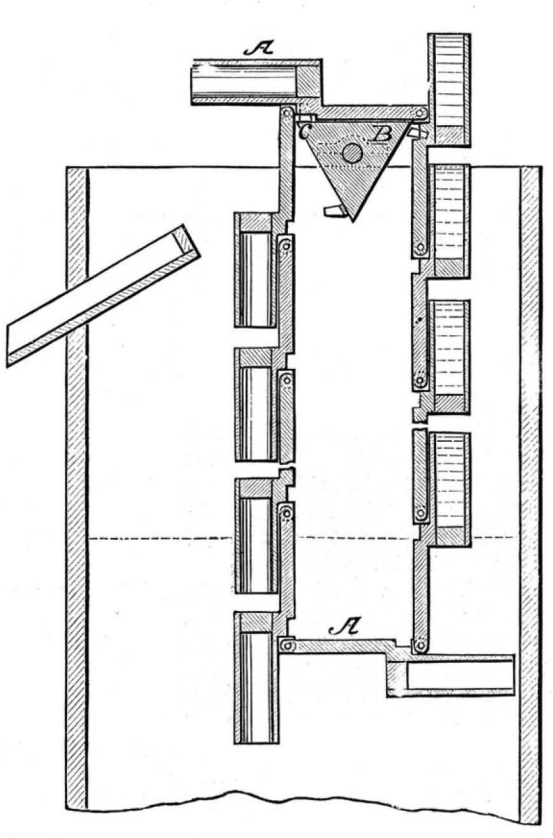
Confervæ are found in single branchless filaments, forming a loose, fleecy stratum, as well as aggregated together in singular forms. The filaments of the *Hydrodictyon utriculatum*, or water flannel, form a tubular purse or net, with regular polygonal meshes, sometimes slender as a horsehair and sometimes so coarse as to feel harsh to the touch. Each articulation gives birth to new filaments, which add new meshes to the net. It is of very common occurrence in ponds and ditches in the middle and south of England.

The researches of those who have sought the infinitely great in the infinitely little have discovered the existence of nervous filaments in even the fungi or embryonic or imperfectly developed organisms. Here are to be seen colored articulated filaments, forming a kind of fibrous crust, sprinkled over with loose granules, supposed to be the fructification. One curious species is found on windows and damp glass in shady places, and, if we mistake not, such a specimen is to be seen in one of the cases of our own New York Aquarium, having been found upon a pane of glass which came from Europe, and was permitted to remain undisturbed. The tendency to vegetate, therefore, would appear universally expressing itself in connection with cells and filaments, in the smallest and simplest organized object which performs the natural operation of multiplying itself; as well as in the larger and more complicated human form. Indeed, simplicity of organization reveals a wonderful persistency of vital principle, producing vast and dense masses, with an extraordinary rapidity of development, alike marvelous and beautiful. The only way to gain an insight into the mysteries of vegetable physiology is the close observation of the hitherto neglected department of botanical studies, the class of plants which are superficially supposed not entitled to even a place in the vegetable kingdom at all.

R. C. K.

A NOVEL CHAIN PUMP.

Mr. Theodore Wallis, of Scipio, N. Y., patented April 17, 1877, the improved chain pump herewith illustrated. Each link, A, is made with an offset, where is formed the lug by



WALLIS' CHAIN PUMP.

which the link is pivoted to the rear end of the next preceding link. The forward parts of the links are made cylindrical and hollow, to serve as buckets for raising the water. The endless chain passes around a triangular wheel, the sides of which are made of the same length as the rear part of the links. To the wheel, at the rear side of each angle, is attached a fork to guide the links into place, and to prevent them from slipping off said wheel. The forks, C, enter rabbets in the links, A, at their shoulders.

With this construction, as the hollow parts of the links, A, pass over the wheel, B, as the same is revolved, the water is discharged from them, and is received in the spout, by which it is conducted into a pail, trough, or other receiver.

The Coffee we Drink.

During the twenty years ending June 30, 1876, the United States imported over 2,200,000 tons of coffee, less than 100,000 tons of which were re-exported. During the year ending June 30, 1877, we imported 320,000,000 pounds of coffee, three fourths of which came from Brazil. For the twenty years mentioned our consumption of coffee averaged 200,000,000 pounds a year. During the last five years of the period it was 300,000,000 pounds. Latterly the relative amount brought from Brazil has declined, owing to the greater increase in the amount imported from other countries. Last year our coffee account with Brazil exceeded the sum of our exports thither by more than $28,000,000.

How to Make a Market for Iron and Steel.

More steel converters will not insure a greater consumption of their products. The need of railroads is only to bring and carry what is produced. The greater the production the greater the population and the greater the necessities of transportation. The greater the wear of rails the greater the demand for steel. The greater the employment in varied production, the greater the demand for implements, machinery, and tools. Now the great iron and steel industry of the United States can only have continual and insured prosperity by insuring a continued profit in the pursuits demanding steel. If there were a million more plows, or reapers, or axes, or looms, or turbine water wheels, or furnaces, or sugar refineries, or ships, or cars, or carriages, or a million of any or all the heavy things in which cheap and fine iron and cheap and fine steel are used, in request, how quick would the steel pulse of the nation feel the more rapid circulation! There is, then, an opportunity for a hint to the steel men in their efforts. A good manufacturer sees to it that he has a market. There is, he knows, no use in piling up even manufactured goods. For what, then, is there a demand? In what can idle capital and idle people be employed to provide renewed demand for iron and steel? If we turn to the statistics of commerce we shall find two facts: That the United States import a large amount of the products of other nations which can at the same time be as well produced at home, doubly rewarding the nation in keeping, employing, and earning what is now paid out. Second, that other nations import large amounts of goods, a great part of which the United States should be engaged in furnishing. Commercial regulations are necessary to enable these industries to assume equal positions; but, more than that, the knowledge of how these things are produced is most necessary, that our capitalists may invest safely, and also that our inventive people may furnish the labor saving appliances.

Among the things imported are $25,000,000 worth of flax products; and $75,000,000 worth of sugar. Where the sugar cannot be raised from cane it can profitably from beets. The flax is an industry indigenous to the country, and only needs the careful discrimination of the knowledge of how to produce to begin it.

Were the $100,000,000 saved among our people which has been paid out to foreign countries during the past ten years, our prosperity would be upon a better foundation. If we were sure that the country would have the employment and use of these two industries of $100,000,000 a year, there would be a far more animated blood passing through our veins than at the present. These two industries are by no means the only ones waiting assistance, but the fact remains that the more employment for labor and capital the more consumption of productions of all kinds.

American Street Cars.

There is perhaps no better illustration of the peculiar excellence of American workmanship than is furnished by the American horse car, nor any better proof of the good policy of superior workmanship than the favor with which these cars are received the world over. American cars are dearer than those made in Europe, yet ours are everywhere preferred, because of their superior lightness, strength, and durability. Wherever tramways exist there they may be found, testifying to the quality of the work of our well paid artisans. The proprietor of a shop which has sent cars to Europe, Asia, South America, and the isles of the sea, says that when the first dozen of American cars were placed on the road of the Bombay Tramway Company, the same number of English cars were introduced. Six months sufficed to prove the dearer American cars to be the most economical, and since then American cars have been used exclusively. The English car is one fourth heavier than the American, giving so much more useless dead weight to carry, and ultimately gives way at the joints.

Illustrated Advertising.

A correspondent of *Land and Water* sends to that paper specimens of illustrations of American agricultural machines and implements, and says that he does not wonder that such American manufactures find a ready market in all the British colonies, and sell in preference to English goods, seeing that such fine wood-cuts are sent out wherever the English language is spoken. The editor of the paper advises English manufacturers to profit by the example of their rivals, and improve their wood-cuts. Possibly, while they are about it, a corresponding improvement in the quality of their goods might also be found advisable.

Our Iron Trade.

After much converse with prominent iron manufacturers, a *Herald* correspondent is confident that, unless unforeseen disaster occurs, we shall soon take the lead of England in this line of manufacture. The present standing of the trade he sets down as follows: In the manufacture of pig iron we have driven England virtually out of our markets, except as to small quantities of Scotch pig iron; our merchant or bar iron is so good that we are able to export large quantities; in iron hardware we beat the world and control the foreign markets.

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LETTERS FROM THE PARIS EXHIBITION.

THE REAPER AND MOWER EXHIBITS.

To the Editor of the Scientific American:

It is probable that the present Exhibition will give rise to no more determined and well sustained contest than that between the harvesters of the various exhibitors. It is understood that the English discouraged any field trials, but the Americans urged that no other test could be valuable or conclusive, and it has now, I understand, been determined upon, and some tracts of grain and grass engaged in the neighborhoods of Versailles and Vincennes on the opposite sides of Paris, and each easily reached by rail.

Nothing in the American section is so amply shown as reapers and mowers, and there are few things upon which we pride ourselves more, and none which have done us more credit. The sewing machine and the breech loading rifle are to be classed in this respect with the harvester, but not before it. In the sewing machine, we have but two exhibits in this Exhibition, the "Wheeler and Wilson" and the "American," though the "Singer" and the "Howe," built in British factories, exhibit in the English section. Sewing machines are not in force as at the Centennial, and no such imposing range of machines of this class as was exhibited in the Machinery Hall in 1876 is to be found here. About half of the machines for which space was secured in New York have not been presented here. The assortment from foreign countries also is more limited than at the Centennial. The business has evidently suffered considerably in the two years last past.

Great struggles are being made by Americans and English to secure the French market for harvesters, and also to impress the representatives of foreign nations in Paris. The Americans are decidedly ahead at present, and if they could keep all they have invented they would be still more so, but patents run out and machines are easily copied, and many American improvements are not patented in England, and so are liable to be pirated at once, and some are taken bodily without regard to right. This is not the case with all English manufacturers; far from it, for there are as fine and honorable gentlemen in that fraternity as can be found anywhere, among whom I would cite the late Mr. Hornsby, of Grantham, England.

Without entering just now into a close comparison between the American and English reapers, some idea of the closeness of the French copies of the American may be gained from the results of a careful examination of the whole French collection, made several times and repeated to-day.

Many French exhibitors show American and English machines, and the names "Système Wood," "Système Johnston," "Système Buckeye," are common in the French Agricultural Annex. Taking, however, those manufactured in the country, we find ten French exhibitors:

1. Liot, of Rouen.
2. Albaret, of Liancourt (Oise).
3. Limare, of Fecamp.
4. Cumming, of Orleans.
5. Hurtu, of Nancis.
6. Pinet, of Abilly.
7. Hidien, of Chartearoux.
8. Renard, of Nantes. (Mower only.)
9. Palente, of Blangy-les-Arras.
10. Laelier, of Soissons.

What I am about to state by way of comparison would to a very large extent apply to English machines also; but we will take the countries one at a time, and when we have done with them we shall have done with the subject. There is no other competition worth mentioning. No reapers are shown from Spain, Portugal, Russia, Austro-Hungary, Switzerland, Belgium, or Holland. The Canadian and Swedish are more bold-faced piracies than either of the others, and will require a word at the close.

Coming back, then, to the French, we may say first what concerns them generally, and it will be seen that as to this division of the subject they are all strictly on American models—in other words, copies of ours.

All the machines, reapers, and mowers have the cutter bar projecting into the grain, the knife with triangular sections reciprocated horizontally in slotted guards, by pitman and gear connection with the ground wheel of the carriage. One might say, "Of course they are, all reapers are;" but these are not all the possible ways of doing the work, and we have good machines in America which come outside of this description. Witness the front cut mower, for instance, which cuts right behind the team. The points cited are all American, and what I say is, that no French substitute seems to have been found.

Then, again, every one of them has a frame hinged directly to the axle of the carriage, or intermediately, to allow of the vertical adjustment of the height of cut. This is American.

Every one has a divider in the grain and a gathering board at the carriage side end of the finger bar. I do not wish to be monotonous, but these are American. So is the grain platform itself, for that matter.

Is that all? Well, not quite.

Every reaper in the French section has a set of revolving sweep rakes, controlled by the Johnston double cam and switch. Each one of them has its adjustments by means of levers, and this also is American.

A number of the machines have the complete four adjustments, namely:

For raising the cutter to regulate the height of cut.

For giving more or less pitch to the guards relatively to the ground.

For operating the switch of the rake cam.

For throwing in and out of gear with the drive wheels.

All the machines have the last mentioned, and I do not insist upon it, as there are many different ways of doing it, and some are probably novel.

Nos. 1, 3, 6, and 7 of the list of firms have all the four adjustments.

Of the other features of the machines it may be mentioned that they are all right hand cut, turning "gee," as we should say, though I own it is impossible to give an idea of the sounds which a French driver utters.

Of the reapers, Nos. 1, 3, 9, 10, are two-wheeled machines. The others (except 8, which is a mower) are single-wheeled.

Nos. 1, 2, 3, 6, 9, 10, are hind cut; Nos. 4, 5, 7, middle cut; that is, even with the main axle.

The seats are nearly all well over to the near (left) side of the machine, and in some cases the driver's perch is on a hinged frame extending away out beyond the drive wheel, and serving as a partial counterbalance. The hinged seats are in Nos. 4, 5, 7. No. 2, the "Perseverante," has a seat forward on the tongue between the horses.

No. 4 contains a dropper machine (an American invention), which has, what I also noticed among some English droppers, a second seat on the carriage for the raker. In some parts of the United States we do not consider a raker necessary with machines of this class. The slats of their droppers are about three inches wide, and with intervals between them less than their width. This may account for the need of a man to rake off. With us, the slats are narrower, and when the dropper falls the heads of the grain catch in the stubble, and the gavel drags off easily and in good order. I notice, however, one American dropper with a raker's seat and rake. Cumming's machines are much above the average of the French.

As above stated, the American machines exhibited by French agents in their section are not included in the above; so I pass by in this enumeration the *Faucheuse Wood*, and *Moissonneuse Combinée Buckeye*, merely smiling at the strangeness of the united names.

Eight automatic binders are exhibited at the Exhibition. Six of these are American, and two English. Six bind with wire and two with string. The names of the manufacturers are:

American.	*English.*
Walter A. Wood.	Howard.
McCormick.	Neale.
Osborne.	
Aultman.	
Wm. Anson Wood.	
Johnston.	

Of these, the last-mentioned in each list use string, the others wire. McCormick uses two wires. We are distinctly ahead of other nations in the matter of automatic binders, as we were in the matter of reapers. Of the two English binders, of which I do not propose to speak now, one is a modification of Walter A. Wood's, and is not yet in order, many of the parts being yet absent, and the other is a novelty which it will take much pains and time to develop satisfactorily. It sweeps the gavel backward on to a second and higher platform, and then sideways to the binder, saving the extra width on the left side of the machine (with a right cut); though as this is over the stubble and helps to counterbalance the weight of the platform, I do not see that this lateral extension is any drawback.

All the American machines have adopted the same means of carrying the grain from the platform to the binder. The plan is familiar to us in the Marsh harvester in which the cut grain is carried by a laterally traversing slatted apron to a second apron which carries it up an incline and discharges it on to a collecting table, from which it is taken, sheaf and sheaf about, by two men who ride upon the machine, bind the grain, and drop the sheaves overboard.

In the binding machines the grain falls in the same way on to the table, and the wire (in one case string) is passed around by a bent arm, which in some respects curiously represents that of a man. The wire comes from a spool in a concealed position below or behind the table, and is threaded along the arm and into the hand which holds the end of it. The arm is made to encircle the gavel of grain and bring the end of the wire to the "standing part," as the sailors call it, at a point close to the sheaf, but between it and the spool. The end and standing parts of the wire, being thus in juxtaposition and parallel, are twisted together five times around, and the tie is complete. A succeeding motion, generally of the sheaf, brings the wires beyond the twist against a cutter which severs them, the new end of the wire being at the time fast gripped in the hand of the arm, which makes its backward motion to allow the sheaf to escape. In Walter A. Wood's machine the sheaf is pushed off the machine by a sort of left arm which has previously aided in compression, so as to obviate the necessity of depending upon the tension of the wire for the tightness of the bind; in some other cases the bound sheaf is pushed off by the one following.

The description of the action is purposely made very general so as to be inclusive, but there are many points of detail showing great ingenuity and involving decided differences in construction. For instance, McCormick uses two spools, and the Johnston binder uses a string about the size of wool twine, which the machine ties in a square knot; the two parts of the string are given a round turn, and the ends passed through the loop and pulled tight. The English string binder, I may here say, makes a reef-knot, which is also a perfectly secure one.

The binding machine is one of the great subjects of the day, the principal one stirring in agricultural engineering, if I may use that term to express what I feel of the admirable skill, persistence, courage, and liberality of the gentlemen who have given their lives, talent, and money to the enterprise. That they have made fortunes is a subject of congratulation on all hands; it is well for them, and an encouragement to the present and succeeding generations. It could never have happened without patents, however, and the people have gained one hundred dollars for every one made by the patentees.

Reference was made above to the anxiety of the American implement maker to secure the French trade, and some details were given as to the almost implicit copying of the American machine. A word on each of these subjects before I close.

Besides the difficulty of distance, with its increased freight, insurance, and so forth, and the added trouble of the time occupied in going back and forth (for a principal must in most cases see his agent now and then), there is another difficulty arising from the fact that we do not stand on as favorable terms as England in regard to the rates of customs duties. England and France have a reciprocity treaty, each mutually admitting the surplus of the other at low rates—English machinery for French claret and silk. It works well for them; but what is the effect on us? Take an instance, to state the matter exactly. An Adriance, Platt & Co. New Model Buckeye weighs boxed 350 kilos. (A kilogramme or 1,000 grammes, called kilo. for short, is almost exactly equal to 2⅛ pounds avoirdupois.) The import duty on this machine is 18 francs per 100 kilos., or 63 francs per machine. English machines are never boxed for the Continental trade, as the distance is so short, and an English mower will weigh unboxed about 400 kilos., on which duty is paid at the rate of only 6 francs per 100 kilos., or 24 francs per machine. There is thus on each machine a discriminating duty of 39 francs against the American manufacturer, besides the extra expenses owing to greater distance, and the value of the boxes with their added cost of freight.

Even under these untoward circumstances the Americans succeed in obtaining the larger part of the trade in harvesters, and are beginning to do a good work in hay-rakes, lawn-mowers, forks, and churns, as well as some other articles. How important the competition has become may be judged from the fact that one of our firms has sold the past year 50 reapers for New Zealand and has 500 engaged for that colony for next year. Another makes a special reaper which is a favorite in South Australia; another person whose acquaintance with American horse rakes began at the Centennial, has since sold 2,000 of one American pattern.

I referred in the earlier part of this letter to some specially objectionable features in the piracies upon our inventions committed by the Canadians and Swedish.

An Ontario implement maker heads his bills "Watson has it," and so I went over to see what he had. I found that he had not alone copied a machine made in the United States, but that he had actually used the irons of the machine for patterns to make castings, and had not even taken the trouble to chip off the numbers and letters, the private marks by which parts are enumerated in order to save trouble of description. The number "700" is cast on the frame, the same as the Adriance, Platt & Co. machine from which it was pirated. The number "50 A" is on the wheel, and is the mark on a wheel of the same firm but of a different sized machine. The machine has carried its ear marks to France, and the castings were recognized in the Exhibition. There is no doubt that "Watson has it," and none as to the character of the man who took it, I suppose.

A curious parallel specimen of Northern honesty is to be found in the Swedish Department. In that section is a sweep rake with the double cam of Johnston, and a frame with the same "700" on it, actually taken from a similar machine of Adriance, Platt & Co., of New York. It seems to be a favorite one from which to pilfer. The Swedish is a dropper with iron slats. The "700" is on the frame, "701" on the lid of the gear box, "702" on the foot plate, and singularly enough their own number, "455," added with paint. It has also the "50 A" on the wheel. They probably thought there was something cabalistic in the figures and feared to remove them. The inscription on the machine is "Westeras Mekaniska Werkstad." So "he has it" also.

It is curious that both of the firms should concur in stealing from the same machine, should let the numbers stay on, and should send them both to Paris to exhibit in company with the original.

E. H. KNIGHT.

Paris, May 24, 1878.

WAGES IN FRANCE.—The United States Consul at Lyons reports that wages have increased in France since the Franco-German war from 20 to 25 per cent., and the cost of living has risen in about the same proportion. The rates now range from 25 cents to $2.50 a day of ten hours for men, 20 cents to $1 for women, and 10 to 30 cents for children. Trade is depressed.

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CATALPA WOOD.

A little over half a century ago General William Henry Harrison, in an agricultural address delivered in Ohio, recommended farmers to cultivate the catalpa because of the great durability of its wood when used for fence posts, etc. He was led to give this advice from having found in an old French stockade at Vincennes, while he was Governor of the then Northwest Territory, pickets of catalpa wood which were yet perfectly sound, although they must have existed in place for more than a century. Lately this tree has become an object of a great deal of attention on the part of arboriculturists, principally on account of the testimony of Dr. Warder and Mr. E. E. Barney and a few others as to the value of its timber.

The catalpa (*Catalpa bignonoides*), although quite extensively cultivated as an ornamental tree in the Middle and Eastern States, is a native of the South and Southwest, having its northern limit in Southern Illinois and Indiana. This tree does not acquire a very large size in the streets, parks, and suburbs of our Northern cities, nor in such situations is it often shapely; but in its native Southern and Western home it is straight and handsome, and often attains a height of fifty feet, with a trunk diameter of three feet or more. The foliage consists of large, heart shaped, long petioled leaves of a peculiar shade of green, and having a silky luster. The tree blossoms in great profusion in June and July, and is then especially ornamental. The flowers, disposed in large showy panicles, are about an inch long, bell shaped, with a five lobed, wavy border, and are white, spotted internally with yellow and violet. The flowers are succeeded by slender, cylindrical, dark brown pods, often a foot long, which hang until spring. These pods are divided lengthwise into two cells, which are filled with flat seeds having cottony wings. When perfectly ripe and dry, the capsules are often used as cigars by boys (the cottony contents readily burning and producing much smoke), and are hence familiarly known as "smoking beans."

Mr. E. E. Barney, the veteran car builder of Dayton, O., has recently brought together all the facts and observations in his possession touching the economic value of this tree, and published them in pamphlet form. From this we learn that there are two marked varieties of the catalpa, one blooming two weeks earlier than the other. The blossoms of the early bloomer are larger, more profuse, and less tinged with purple; pods longer and finer; the bark dark colored and furrowed, resembling the bark of elm and locust trees of the same age. The bark of the late bloomer is laminated, comparatively smooth, and light colored. The earlier variety is of more rapid growth, and is straighter and taller, and has been found to endure a winter that killed the other. Mr. S. H. Binkley has on his farm, several miles from Dayton, a grove of six hundred catalpa trees, of the late blooming variety, planted from seeds twelve years ago. They are now from 25 to 30 feet tall and from 4 to 8 inches in diameter at the ground. They would now make twenty-five hundred fence posts. Eighteen years ago, while repairing a fence, Mr. Binkley, lacking a few stakes, trimmed up some catalpa limbs, three or four inches in diameter, and used them for stakes, thinking they might last one season. A recent examination of these stakes, which have been in the ground for eighteen years, has shown them to be perfectly sound. The valuable qualities of the tree, to sum up the evidence presented by Mr. Barney, are: Its easy and rapid growth in almost any kind of soil, freedom from the attack of insects, and the great value of its timber as regards its durability either in the earth or exposed to the air. The principal demand for the timber will be for railroad ties; for this purpose wood should be durable when exposed to the weather, and neither too soft to resist crushing weight on the rails nor too hard to hold the spikes properly. These qualities, Mr. Barney asserts, are found combined in the catalpa. In addition to its durability, catalpa possesses qualities that render it one of the very finest of woods for inside finish and cabinet work, inasmuch as it has a beautiful fine grain, of a warm yellow color, and is susceptible of a high polish.

Mr. Barney's pamphlet is published for the purpose of disseminating knowledge as to the value of the tree and to promote its cultivation. The author estimates that at present prices a plantation of catalpa will yield a return of $25 per acre for each year of the time during which the trees occupy the ground. Mr. S. Foster, a horticulturist of Iowa, thinks that the common (or late flowering) variety cannot be depended upon north of St. Louis, while the early bloomer has endured the severest winters of the Western States without injury.

American Trade with Belgium.

Mr. Weaver, U. S. Consul, at Antwerp, reports to the Department of State that in exports to Belgium the United States rank next to Great Britain. Our direct trade with that country exceeds $25,000,000 a year, and with more direct steam communication might be largely increased. The staple American articles having a firmly established sale in Belgium are breadstuffs, petroleum, oils, rosin, turpentine, cured meats, lard, tallow, tobacco, dye woods, copper, minerals, clays, drugs, honey, canned provisions, cotton, lumber, and, recently, fresh oysters. To maintain the trade in these productions, great care as to the quality and packing is indispensable. The imports of cotton are decreasing for want of direct communication with our cotton ports. The lumber trade might be increased were the facilities greater for discharging such cargo at Antwerp. The prices of fresh meats, eggs, butter, etc., in the Belgian markets, seem to warrant their direct importation in refrigerator ships. Belgium being the most successful manufacturing state on the continent, the market for American manufactures there cannot be very large; still, the Consul thinks that, in addition to the usual list of agricultural and mechanical implements, household notions, sewing machines, and so on, our machine-made horseshoes and nails, school furniture, carriages, and wheelwrights' supplies, match splints, gutta percha harness mountings, wooden boottrees, lasts, and possibly tram cars, might be profitably sold. In introducing new wares the prevalent styles and taste in Belgium should be conformed to. Above all, economy must be consulted, for, unless cheaper as well as better than Flemish goods, American wares will not sell there.

FENCE ECONOMY.

Dr. Franklin B. Hough, in his recently issued "Report upon Forestry," prepared under the direction of the Commissioner of Agriculture, says that according to recent estimates the cost of the fences in the United States amounts to $1,700,000,000, and the annual expense of maintenance is $198,000,000, excluding interest at 6 per cent on the original cost. We confess to never having had much faith in the accuracy of big-figured statistics of this sort, for the reason in this case that we fail to see exactly how they are reached. Perhaps to take the totals representing one State would be to convey a better idea, and these are furnished by estimates made by the Maine Board of Agriculture, which fix the total length of fences in that State at between 127,000 and 131,000 miles. The first cost is reckoned at $1 per rod, and the interest on this sum, with repairs, etc., comes to about $6,000,000 per annum. This excludes the value of the land covered by the fence itself, which at $30 per acre is worth $975,990.

With some notion of the large sums invested in fences thus attained, it is not at all difficult to realize the importance of the statement quoted by the author, to the effect that "from one quarter to one eighth of the present fences of the country would be amply sufficient to keep stock within proper limits, especially since it appears that we are wasting money through a wrong appreciation of the use of fences which any one, so far as he is personally concerned, can remedy for himself.

The question is, Are we to fence to keep cattle out of fields where they are not wanted, or in fields where they are? The general rule is to do the first; but just here, Dr. Hough says, we are doing exactly wrong, and hence by simply changing our practice the way to economy is open. It is very much cheaper to fence the adjacent lots of a large field than it is to fence each lot separately. Supposing, for instance, an area of one square mile be divided into four 160 acre lots. These, if adjacent, would require 1,920 rods of fence. If separate fences were erected about each lot, then the length of fence would be 2,560 rods. Supposing the number of fields to be 64, of 10 acres each, if adjacent, 5,760 rods of fencing would be needed; separate fences would require 10,240 rods, and here there would be a saving of seven rods of fence per acre; that is at $1 per rod, $7 per acre, or on the entire area the neat sum of $4,380. The difference is saved by the same subdivision fences answering for the adjacent fields.

American Carpets.

Our production of carpets is larger than that of any other country in the world. In 1875 the value of the product was $32,376,168. In 1872 our importations of carpeting amounted to nearly $6,000,000; in 1877 they were only $674,911. In their report as to the character of American carpets, the Centennial judges said: "The proofs at the Exhibition of our attainments in this manufacture were observed with no little surprise. It was manifest, from the absence of rival foreign exhibitions, that in respect to the carpets of the cheaper and medium qualities, up to the two and three ply ingrains, the competition is confined to our own manufacturers. Even rival English manufacturers generally admitted that in the production of Jacquard Brussels, tapestries, and Wiltons, and narrow Axminsters, we have nothing to learn from them either in design or fabrication."

It is worth remarking in this connection that when American inventors undertook the task of devising carpet weaving machinery, the work was all done on hand looms by men. Now women and boys do all the manual labor. In 1844, a man with a helper could weave not more than seven yards of Brussels carpet in a day. Now a girl will weave fifty yards in that time.

The Influence of one Mill.

A single woolen mill in the city of Lawrence produces every week a million yards of dyed or printed cloths. It pays $160,000 a week as wages. It employs 5,300 persons, paying them at an average rate of 95 cents a day to women and girls, and $1.40 a day to men. It consumes 500 tons of starch, and expends $400,000 for printing and dyeing materials every year. The wool it requires calls for the fleeces of 10,000 head of sheep. It secures food, clothing, and usually respectable savings to 5,300 persons and their dependents—not less than 10,000 souls altogether. This, with the freights paid for transportation of its materials and products, shows what one mill contributes to the wealth, power, and prosperity of the country. The woolen industry of the whole country amounts to more than $200,000,000 a year. There are nearly a thousand woolen mills in Ohio and other Western States.

The South as a Field for Manufactures.

In a speech on the Texas Pacific Railway, Senator Lamar lately dwelt at great length on the natural advantages of the South for successful manufacturing. Every condition of soil, climate, and raw material for the development of a great industrial community are there. The South has already begun her industries of the future, and the profits that are realized from them are, in some instances, prodigious. But to develop these industries, she must have free access to the markets of the world, and be able to attract to herself the skill, and capital, and machinery, and appliances of the North. In the South land, food, raiment, and shelter are cheap, and taxation is growing every year less burdensome. In everything except capital, skill, and experience, the manufacturers of the South are on an equality with those of England, and the saving in baling, waste, and transportation gives the South great advantages. Nowhere in the world can cotton be manufactured so cheaply as on the spot where it is grown, where water power is so abundant and unfailing; and every factory set up there will help to develop the diversities of Southern agriculture. The cotton crop last year amounted to 4,700,000 bales; yet the Southern States have but a small part of their cotton lands under cultivation.

Glass Making at Pittsburg.

Pittsburg has 72 glass factories, covering an aggregate area of 200 acres. Twenty-two of these establishments are devoted exclusively to the manufacture of window glass, the remaining fifty to bottle glass, table ware, lamp chimneys, and so on. The work of some of the best of the window glass factories is considered equal to any foreign product. Fully 5,000 persons are engaged in this branch of the glass industry, and the annual product is not less than 800,000 fifty foot boxes a year. The wages now paid to first class men range from $100 to $130 a month. Second class men get $65. In the making of bottle glass, from a half drachm vial to a twelve gallon carboy, American manufacturers claim to beat the best foreign products, with the exception of one particular style of wine bottle, in which Germany excels. In the manufacture of fruit jars, represented by ten factories in Pittsburg, the American article is far superior to the European. There are no plate glass factories in Pittsburg, though they have been successfully established in Indiana and Missouri. The Indiana factory is turning out as good an article as the French, and the machinery used was made at Pittsburg. As yet no cut glass worthy the name is made in Pittsburg, the art of cutting not being well understood, and the demand for this quality of glassware not being sufficient to warrant the importation of skilled and artistic labor from Europe. The moulded table ware is good and cheap, so that a considerable quantity is exported.

Work for New York City.

Referring to the effect of the opening of the Mississippi in furnishing a water way for the commerce of the interior, Senator Windom said that to meet such competition New York must no longer rely upon her present advantages. She must not only give to commerce a free harbor and a free and improved canal, but she must also exert her powerful influence for the removal of all obstructions and impediments to the movements of commerce on the lakes. Nor will this be enough. To give the Northern route its highest degree of efficiency and power, the Lakes and the Mississippi must be connected by a canal, which will make the upper Mississippi river the base line of New York's commerce, and thereby unite the two great systems of lake and river transportation.

American Workmanship.

In the course of a description of a visit to the French war vessel, the Richelieu, a foreign correspondent remarks that it seems impossible for one to go anywhere without some specimen of American ingenuity cropping up; accordingly, on the quarter deck of the Richelieu was a Gatling gun beside a mitrailleuse. It is astonishing, the correspondent adds, how tasteful Americans are in everything relating to machinery. The Gatling, beside the dull, heavy, somber French piece, looked like a bit of jewelry, its steel and brass flashing like gold and silver in the bright sunlight of the Mediterranean. And this is the more noteworthy because the French have a decided bent toward decoration, and generally make things look as well as possible.

Progress in Hard Times.

Notwithstanding the times, it is doubtful if the country ever made greater or more rapid progress in substantial wealth than during the past seven years. From a comparison of the statistics of the census of 1870 with those furnished by the Bureau of Agriculture for 1877, it appears that there were 31,000,000 more acres of land under cultivation last year than in 1870, an increase of 34 per cent. The percentage of increase in the number of corn produced was 22½; of wheat, 52; of rye, 42; of barley, 35; in tons of hay, 34; and in pounds of tobacco, 91 per cent. The live stock over the aggregate of 1870 was, horses, 44 per cent; mules, 45; cows, 26; oxen and other cattle, 29; sheep, 25½; swine, 28 per cent. The aggregate increase in the number of live animals amounted to about 25,000,000 head. The excess of the grain crop of 1877 over that of 1870 was nearly 550,000,000 bushels. Our exports for the year ending June 30, 1877, exclusive of gold and silver, amounted to $632,980,080.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Alcott's Turbine received the Centennial Medal.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

New Lathe Attachments, such as Gear Cutting, Tap and Spline Slotting. W. P. Hopkins, Lawrence, Mass.

Wanted.—A situation by a practical man as Manager or Foreman in a Machine Shop or general repairs of any kind Can give references. Address W. Wathe, Woonsocket, R. I.

Removal.—Messrs. Goodnow & Wightman, makers of Small Tools, Model Engines, etc., have removed from 23 Cornhill to 176 Washington St., Boston Mass

I want 2d hand 48 in. Gap Lathe. O.S., Bridgeton, N.J.

Wanted.—Engagement by a practical Mechanical Draughtsman. Can design and superintend erection of Machinery. Address Charles Richards, 15 Webster St., Cleveland, O.

Band Saws, $100; Scroll Saws, $75; Planers, $150; Universal Wood Workers and Hand Planers, $150, and upwards. Bentel, Margedant & Co, Hamilton, Ohio.

For Sale.—A Set of Eccentric or Die Rolls, with Bed Plate. Housings and gearing all complete, in first class order. Henry Disston & Sons, Front and Laurel Sts., Philadelphia, Pa.

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Best Steam Pipe & Boiler Covering. P. Carey, Dayton, O.

Cornice Brakes. J.M. Robinson & Co., Cincinnati, O.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Painters' Metal Graining Plates. J.J. Callow, Clevel'd, O.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Foot Lathes, Fret Saws, 6c., 90 pp. E. Brown, Lowell, Ms.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

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Safety Linen Hose. Protects factories and stores. Saves insurance. Greene, Tweed & Co., 18 Park Place, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

The Scientific American Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the Scientific American, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Cheap but Good. The "Roberts Engine," see cut in this paper, June 1st, 1878. Alse horizontal and vertical engines and boilers. E. E. Roberts, 107 Liberty St., N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

For Shafting, Pulleys, Hangers, etc., send for price list and discount to Hilles & Jones, Wilmington, Del.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Polishing Tools and Supplies. Send for new price list. Greene, Tweed & Co., 18 Park Place, N. Y.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the Scientific American Export Edition. This paper has a very large foreign circulation.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 398. John Edwards, P. O. Box 786, N. Y.

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For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

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Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

F Lunkenheimer's Brass Goods for Engine Builders, Automatic Oil Feeders. Glass Oil Cups Cody Shaft Oilers. etc. Address Cincinnat Brass Works.

NEW BOOKS AND PUBLICATIONS.

The Magazine of Art is a new illustrated monthly periodical, published by Cassell, Petter & Galpin, of London, Paris, and New York. It is devoted exclusively to what are known as the fine arts, in contradistinction to those pursuits which, while arts, are not included under the narrower and higher term of art. The initial number is quite up to the high standard which is aimed at; is replete with illustrations, some of the cuts being of unusual excellence; and the descriptive text and miscellaneous art notes furnish much interesting information. It is intended to draw largely upon the resources offered by the Paris Exhibition, with its great array of art treasures; and certainly the *Magazine* enters upon its career with remarkable facilities.

Notes & Queries

(1) A. P. asks how to prepare a strong solution of silver-potassium cyanide. A. Add to a solution of potassium cyanide silver nitrate solution until no further precipitation is occasioned; after settling, pour off the liquid and wash the precipitate several times with water; then dissolve it in the smallest possible quantity of a strong aqueous solution of potassium cyanide by the aid of gentle heat.

(2) A. P. R. writes: 1. I am about to put a feed water heater into the smoke arch of a boiler (locomotive type) on a steamboat. The heater will be made of several rows of steam pipe passing backward and forward by the ends of the tubes in the smoke arch, being heated by the heat from the furnace. The water is to be forced through the pipe by a Blake steam pump. Will it work well? A. Probably you will need a blower, or some equivalent. 2. Where should the check valve be put in? A. Place it close to the boiler, with a stop valve between that and the boiler.

(3) O. H. T. asks: What liquid can be vaporized with the least expenditure of heat? A. Perhaps liquid hydrogen. The boiling points of several of the more volatile liquids are as follows: Sulphurous anhydride, 17·6° Fah.; ethyl chloride, 51·9°; methyl bromide, 55·5°; aldehyde, 69·4°; methyl formiate, 92·1°; ether (ethylic), 94·8°; ethyl bromide, 105·8°; methyl iodide, 111·4°; carbon disulphide, 118·5°; formic ether, 127·7°; acetone, 133·3°; methyl acetate, 133·3°; bromine, 145·4°; wood naphtha (methylic alcohol), 149·9°; ethyl iodide, 158·5°; acetic ether, 164·9°; alcohol (ethylic), 173·1°.

(4) A. O. asks: Is there any advantage in having a pair of cone pulleys turned, the one concave and the other convex on their face? A. We think not.

(5) F. S. asks: With what can the brass taps of steam boilers be varnished, to prevent tarnishing? A. Dilute alcoholic solution of shellac or sandarac is sometimes used. It should be applied while the metal is warm.

(6) W. P. asks for a formula for making an invisible ink which will become visible on the application of some dilute acid. A. Use dilute copperas (iron protosulphate); tannic acid or any liquid containing it (as strong tea) quickly develops a black ink when brought into contact with the writing. Dilute nitric acid or chlorine water will also render the writing visible, especially if treated afterward with a drop of ammonia or potassium ferrocyanide.

(7) C. K. asks: What will cement hard rubber? A. Fuse together equal parts of gutta percha and genuine asphaltum; apply a very little hot to the joint, closing the latter immediately with pressure.

(8) In answer to F. C., S. H. K., and others, who ask how to make an aquarium watertight.—The joints may be packed in caoutchouc, and further sealed with a cement prepared by melting together over a gentle fire 1 lb. of resin, 4 ozs. of good tar, and about 1 oz. of linseed oil. If an excess of oil is used the cement will become too fluid; to obviate this it should be tested before use by allowing a small quantity to cool under water, and if not sufficiently firm, allowed to simmer longer or have more tar and resin added. The cement should be poured in the angles of the aquarium while in a liquid state, but not when boiling, as it would crack the glass. The cement, when properly made, becomes firm in a few minutes.

(9) J. G. S. asks: What would be the approximate cost per mile of a narrow gauge railroad, complete, through a level country? A. The cost of such a railroad will, of course, depend on the character of the country and the length of the road. The following estimate was made for a road of 3 feet gauge. 100 miles long, over a prairie country: Grading, bridges, ties, tracks, stations, etc., $9,520 per mile; rolling stock, $3,791 per mile.

(10) W. H. H. asks: What is the process commonly practiced in bleaching white goods? A. The goods are first immersed in dilute solution of chloride of lime (bleaching powder), and then transferred to a vat containing very dilute sulphuric acid. This treatment may be repeated if necessary, and the material finally thoroughly washed.

(11) O. H. K. writes: I have a steam launch, and condense the exhaust through a copper pipe running around the stern close to the keel. Some persons tell me that the feed water will injure the boiler from the action of the copper pipe. Is this the case, and if so is there any remedy? A. Any deleterious action can be prevented in great measure by tinning the pipe.

(12) P. C. O. asks: How shall I loosen the scale in a steam boiler? A. Without knowing the character of the scale, we cannot suggest any remedy. Generally, by allowing the water to remain in the boiler until cold, the scale is softened so much that it can easily be removed. If there is a great accumulation, this blowing off must take place very frequently.

(13) W. & B. write: We have a garret room that we wish to ventilate so that we can work in it. It has a sheet iron roof, is 25 x 90 feet, and 7 feet high; has two windows in each end, but they do not give air enough. Could a fan be put in the roof; and if so, of what kind? A. If you have an opening to admit cool air, and another for the discharge of heated air, a suction blower placed by the latter opening, or a pressure blower by the former, will answer very well.

(14) S. E. T. writes: I am building a tank 7 x 8 feet, 6 feet deep, in my stable to hold water for household purposes. It is made of pine strips, 1½ in. x 2 in., laid flat, with whitelead joints. Do you think it will be necessary to line it, and if so, what had I better use? A. It will not be necessary to use any lining, if properly made. If, however, you desire to do so, waterproof paper will answer very well.

Is it advisable to let the water from the leader of a bay window and piazza run into the trench filled with broken stone which forms the foundation of a drive way? A. We think not.

(15) C. D. asks: How shall I make a "bellows body" (like an accordion) for a camera, to be of ⅛ inch strips, 5½ inches wide, and 8 inches high when finished? A. Cut the four strips to size, stitch the edges of the sides together at points 3 inches apart, push in the edges between each of these points to form the base of the hinges, and insert the gore pieces. These may be 3 inches wide and 3¼ or 3½ inches long, slit lengthwise ⅛ to ¼ inch on the middle line at each end, and the corners folded toward the center to form a square about 2$\frac{1}{16}$ inches wide; then placed reverse side down and folded once to a triangle. A few blows with a mallet will then set the folds. The pieces are inserted, obtuse angle outward, in the seam edge of the hinge, and the slit edges unfolded and glued to the infolded portions of the hinge.

(16) "Sapphire" asks what cement is used by lapidaries for cementing precious stones. A. Armenian or diamond cement. Soak isinglass in water until it is soft; then dissolve it in the smallest possible quantity of proof spirits by the aid of gentle heat (over warm water); in 2 ozs. of this dissolve 10 grains of pale gum ammoniacum (in tears) by trituration in a mortar; then add six large tears of gum mastic dissolved in not more than 6 times their weight of rectified spirits. Keep in a well stoppered bottle, and soften for use by standing the bottle in hot water.

(17) W. H. A. asks for a recipe for making a good indelible ink, in shape that can be conveniently applied by means of a rubber stamp. A. Genuine asphaltum, 1 part; benzole, 4 parts; dissolve and temper with good printer's ink.

(18) R. H. H. writes: A friend and myself had a dispute in regard to steam boilers. I claim that, with a full supply of water in the boiler, and not using any steam, you can get pressure enough to burst the boiler by keeping up a hot fire. My friend claims a boiler cannot burst with steam pressure so long as the supply of water is kept up. A. If you get pressure enough, the boiler will be ruptured all the same, whether it contains water or not.

(19) F. G. S. asks for a recipe for black varnish. A. Amber, 1 lb.; fuse; add hot drying oil, ½ pint; powdered black rosin and Naples asphaltum, of each 3 ozs.; when properly incorporated and considerably cooled, add oil of turpentine, 1 pint. This is one of the finest black varnishes in use.

Also a recipe for a japan. A. Shellac, 1 oz.; wood naphtha, 4 ozs.; lamp black or ivory black to color.

(20) S. P. S. asks: What is the proper course of study for one who wishes to become a steam engineer? A. He should study works on mathematics, natural philosophy, and prime movers; and should also study actual examples of steam machinery. In addition, he should practice drawing and the use of machine tools.

(21) In answer to O. T. K.—If you take the dimensions of a large engine, say 24 x 48, you can get a fair idea of what is needed for an engine built on a smaller scale, $\frac{1}{8}$ in the case you mention.

(22) C. W. K. asks: In the propulsion of a boat, is the speed attained in direct proportion to the power employed; if not, what proportion does the power bear to the speed? A. The ratio is not exactly determined, as it is not constant at all speeds. For moderate speeds, the power varies nearly as the cube of the speed.

(23) G. I. B. asks: What should be the dimensions of a floating dock large enough to lift and contain a vessel of the following dimensions: 300 feet long, 40 feet beam, and drawing 22 feet of water? A. Having fixed the shape of your dock, you may assume that each cubic foot of water displaced by it requires a load of 62·5 lbs., from which data you can obtain the requisite dimensions.

(24) W. S. W. writes: I have a clinker built boat, 20 feet long and 6 feet beam, which I wish to convert into a steam launch. Is a screw of more advantage than a paddle wheel, and if so, what size engine and what kind should I use to give a good rate of speed? A. You can use a vertical engine, 3 x 5, and a propeller with diameter equal to draught, and 3 feet pitch. We think this arrangement will be more desirable in some respects than paddle wheels. If the boat is very light, it may need to be stiffened somewhat for the machinery.

(25) In answer to T. L.—The expansion of various metals, on being heated 1°, is as follows:

Zinc	1-61920	Copper	1-104400
Pewter	1-78840	Gold	1-123120
Lead	1-63180	Wrought iron	1-149000
Tin	1-87840	Steel	1-151200
Silver	1-95040	Cast iron	1-162000

(26) T. A. P. asks: 1. Can I make a small rowboat by stretching canvas upon a wooden frame? A. Yes; such boats are sometimes used for hunting. They are easily damaged. 2. How can I make the canvas waterproof? A. Paint it, after securing to the frame, with whitelead or other good paint.

(27) In answer to J. R. E.—The samples of test paper appear to be georgina (dahlia) paper, prepared by steeping slips of white, uncalendered paper in a not over strong tincture of *Georgina purpurea*. It is found in most well ordered laboratories. Though ordinarily not quite as delicate in reaction as litmus, it may often be conveniently substituted for the latter The faint purplish color of the paper is rendered pinkish red by dilute acids and green by weak alkalies.

(28) E. O. H. asks: At what rate does sound travel? A. At 1,090 feet per second in air, under ordinary conditions.

What preparation can be applied to the inside of pottery to make it waterproof? A. Almost any of the vitreous glazes will answer. Borax, flint, glass, etc., are commonly used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. W. C.—Slate containing pyrites.—J. A. P.—The deposit consists mainly of clay, silica, lime sulphate iron oxide, and a little organic matter. It may be used as a cheap pigment, either before or after calcination. It does not contain phosphates.—J. J.—No. 1 is red jasper, an impure quartz, the coloring matter of which is iron sesquioxide. No. 2 is dolerite, containing iron pyrites, of no value.

COMMUNICATIONS RECEIVED.

The Editor of the Scientific American acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Hearing by the Teeth. By W. B. W.

Antiquity of Civilization. By F. S. J.

Science of Light. By T. B. McC.

A Mechanical Question. By J. D. H.

Causes affecting the Taste of Drinking Waters. By J. L. M.

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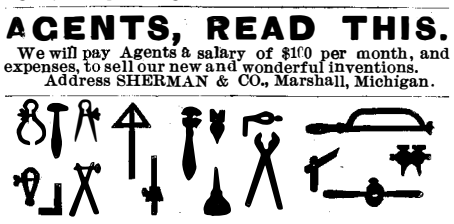

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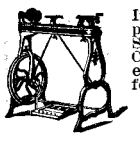

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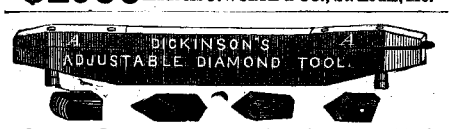

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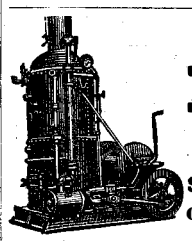

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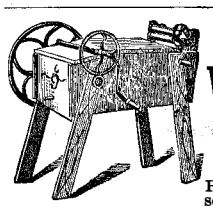

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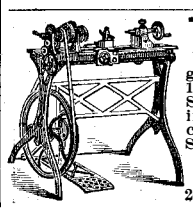

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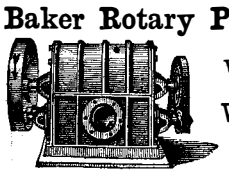

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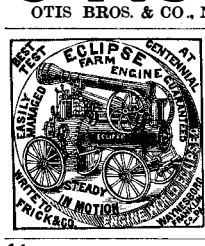

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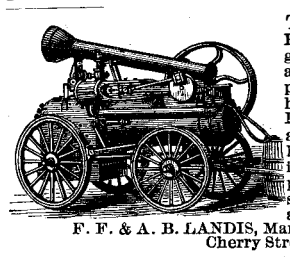

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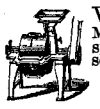

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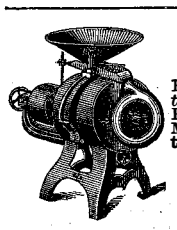

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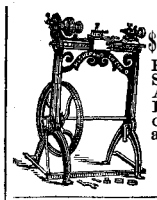

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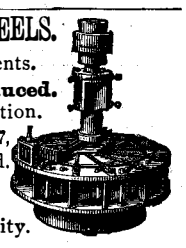

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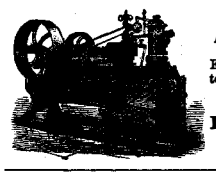

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